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SCIENTIFIC AMERICAN

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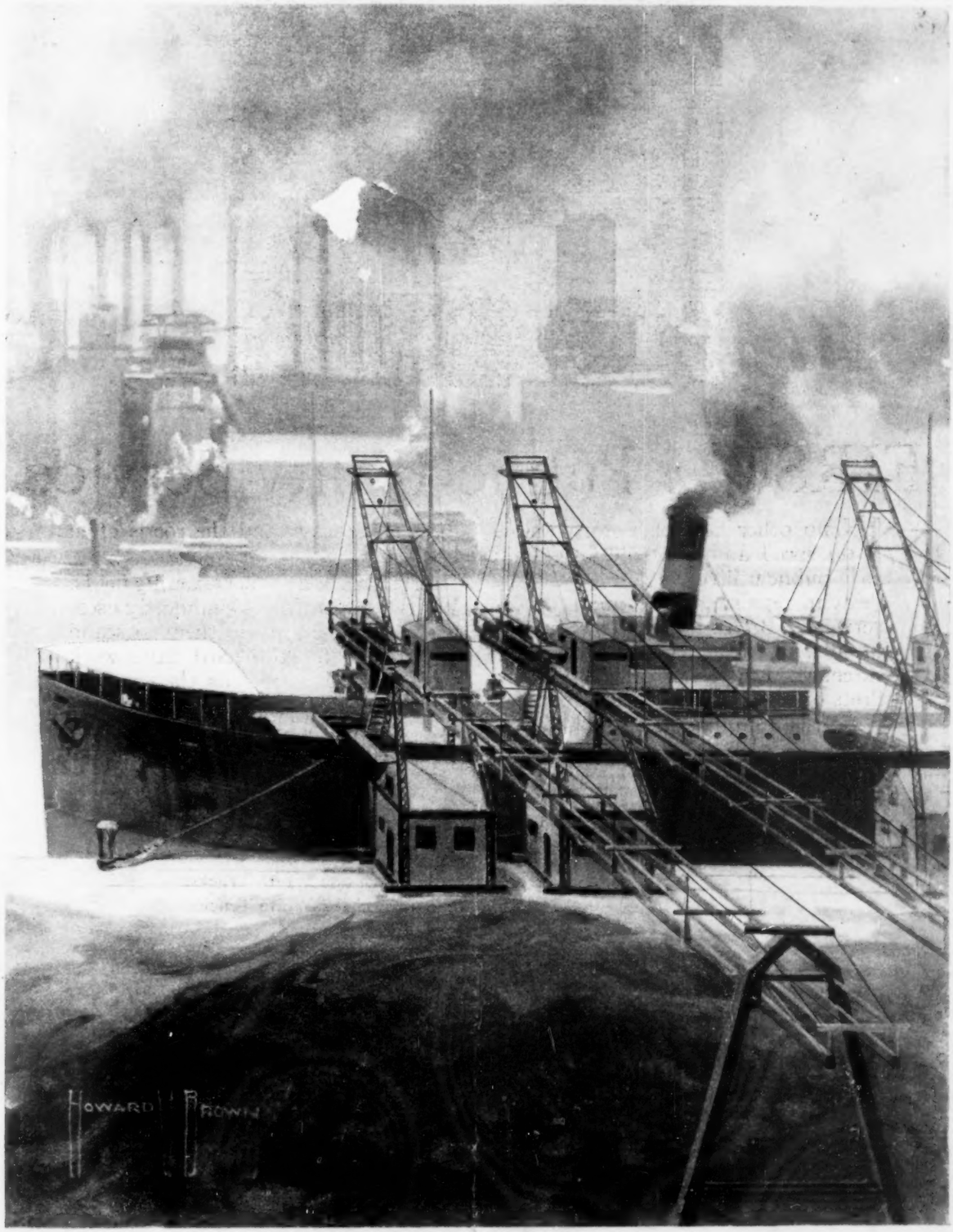

TRANSFERRING COAL FROM SHIP'S HOLD TO THE COAL PILE

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SEVENTY-SIXTH YEAR

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A general view of Seattle's new pier, second in the world in length and first in area

Seattle's Record Pier

By Ralph Howard

THE Port of Seattle's new Smith's Cove Terminal Pier "B" is completed, and the fact that the port has made arrangements with two of the largest steamship companies on the Pacific Coast for the use of this terminal, shows the need of such a facility.

This pier is 367 feet wide and 2,560 feet long, only lacking 60 feet of being a half mile. It is the largest commercial pier in the world, even surpassing in square foot area the huge Chicago Municipal pier, which is, 3,000 feet long.

This pier will have two transit sheds, 130 feet wide by 1,000 feet long at the street end, the outer section of the pier being uncovered, and given over for the handling of export freight. The north 500 feet of the east transit shed has been finished and as the construction crew were leaving the work, the "Horalsan Maru" began discharging 10,000 tons of cargo, consisting of nitrates, sugar, etc., into the transit shed for transshipment. Bids were requested for the construction of the north 500 feet of the west transit shed; these proposals were opened August 25, 1920, and the work contracted for at that time.

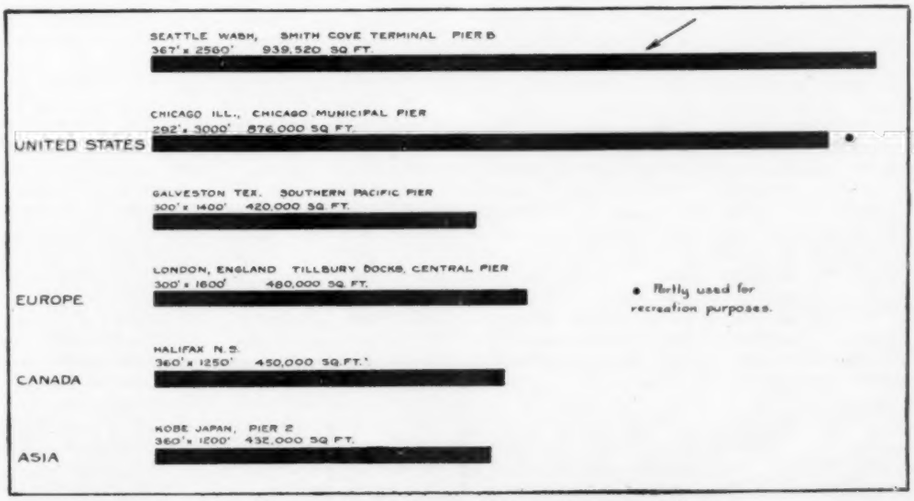
One of the outstanding features in connection with the equipment of this pier is the amount of railroad trackage, there being approximately 4½ miles of trackage consisting of two shipside tracks on outer sides of pier, together with four depressed tracks in the center, with numerous cross-overs in order to facilitate switching. It was decided to install this great amount of trackage since very satisfactory results have been obtained in the operation of the similar Smith's Cove Pier "A," which has 3½ miles of railroad trackage.

The port of Seattle has made satisfactory arrangements with the largest American steamship company on the Pacific Coast, and the largest Japanese steamship company entering Puget Souad for the use of Pier "B," the former being given preferential right for the use of the east side of the pier, while the latter has been given preferential right for the use of the west side of the pier. It is understood, of course, that when the ship berths and storage space are not used by either of these companies, the Port Commission will have the right to berth other ships and use storage space as required in order to place the terminal in maximum use.

Elaborate passenger accommodations and baggage inspection rooms are to be installed on the second floor at the street end of each shed for the accommodation of transpacific passenger traffic. A large commodious waiting room will be located on the water side of the second floor of each shed, this location being an ideal one from a fire hazard standpoint, besides giving the passengers easy access to the street. Just opposite and on the other side of the shed will be located the baggage inspection room, thus making it very convenient for the passengers.

Along the face of the pier, portable adjustable ramps will be provided, allowing passengers to leave the ship and enter the second floor in close proximity to the waiting and baggage rooms on an easy grade and without crossing any railroad tracks on the same level. The portable ramps will be made adjustable for any stage of the tide and will be electrically operated, making their operation simple and economical. Overhead bridges will be installed connecting the second floor of transit sheds with the overhead Garfield Street viaduct, enabling passengers to reach the street on the same grade, avoiding congestion of railroad and vehicular traffic on the lower floor from the time they leave the ship until they reach the street car line, taxicabs or waiting automobiles on West Garfield Street.

Since the oriental passenger boats also carry a large amount of freight, Smith's Cove Pier "B" will be most suitable for this class of business, for the import cargoes can be discharged and stored in the shed at the same time the passengers are leaving. To expedite the handling of this freight in the shed, a great variety of light handling equipment will be furnished. After the ship has discharged her passengers and her import cargo, she can then be warped along the pier to the large open wharf to take on her export cargo. Again, on the open wharf, a great variety of heavy mechanical handling equipment will be provided to expedite the loading of these vessels.



Graphic comparison of some of the world's largest piers

Where the Lumber Goes

WOOD alcohol, as odious as it now appears in the public eye, has its proper uses. And the effort of the Forests Products Laboratory, Madison, Wis., to improve the quality of the liquid is legitimate—not, however, with the viewpoint of popularizing it as a beverage. Also, grain alcohol may in the future be extracted from waste wood accumulating around the sawmill or from scraps salvaged around newly-constructed houses.

From woodland to the bungalow in which you live, more than 60 per cent of the timber supply cut goes to waste, each of the transforming processes taking its toll of extravagance. How to utilize this large waste material is taxing the ingenuity of forest experts—the range of conservation involving anything from perfecting a better quality of wood alcohol to a baseball bat made from scrap lumber. Emphasizing the importance of recovering the huge timber waste, from the time it is felled in the forests until the last nail rivets the woodwork in the new house, the United States Forest Service has designed a unique model.

Situated on this diminutive scale of operations are representations descriptive of the successive stages through which timber passes—a growth of uncut trees, sawmill, planing mill, wood-working establishment, tanning factory, and a newly built home. Descriptive text is accessible to indicate the estimated percentage of loss credited to each of the varying processes of converting the trees into usable material.

At the fountain source of our timber resources—the growing woodlands—16 per cent is squandered in tops, limbs and stumps; 10 per cent is represented in edgings and trimmings; sawdust takes a toll of nearly 11 per cent; 10 per cent is wasted in slabs; bark represents nearly 11 per cent of waste; something over 5 per cent is lost in seasoning; careless manufacturing loses 2½ per cent, while the planing mill renders irrecoverable still another small increment of something in excess of one per cent.—By *S. R. Winters.*

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Choosing a Secretary of the Navy

THE Navy has passed through more than one crisis in its history, and it is passing through a crisis today. The causes are many, and prominent among them are the policies, and even more, the mental attitude and outlook of the man who has filled the position of Secretary of the Navy for the past eight years. Selected for the position, apparently because of his out-and-out political sympathies, he found himself, on taking office, at the head of a vast and complicated institution of which technically he knew very little, if anything at all. With the spirit and traditions of the Navy, in their deeper and more spiritual significance, he seemed, from the very first, to be utterly out of touch—an estrangement, alas, which the passage of the years has seemed rather to accentuate than diminish.

And now we are to have a new Secretary, whose duty it will be to conserve the best of what the preceding administration has secured, and repair what many men within the Navy will tell you is the irreparable damage which has been wrought during the past eight years upon the traditions, the morale and the teamwork of the Navy as a whole. We believe that the following suggestions, as a basis of choice will commend themselves to those who have the highest interests of the Navy at heart.

In the first place, the Secretary should be selected as far as possible without any regard to his political color. We want no repetition of Danielsism. The Secretary's first thought and his last must be, not how this or that measure affects his political party, but how will his policies help to build up the Navy and make it a more effective instrument of defense?

Secondly, the new Secretary should have some knowledge of the Navy and its work, such, for instance, as was possessed by Mr. Daniels' able coadjutor, Mr. Franklin D. Roosevelt. Unless a man has had sufficient interest in naval affairs to possess himself of some knowledge of the history of the Navy, its present international standing and the functions of the various types of warships, he should be passed by. There are several men in political life who are qualified in this respect. They can be found in the naval committees both of the House and the Senate. Some, indeed, such as Senator Weeks, have passed through Annapolis and are thus admirably furnished to grapple with the questions of policy, personnel and materiel. It is a monstrous absurdity that a new Secretary should be so ill-informed as to have to learn the elements of the naval game at the very time when he is called upon to make decisions on the complicated questions which crowd in upon him from the very day that he enters upon his duties.

In handling the personnel of the Navy, the Secretary should play no favorites. He should be sympathetic alike with the officers and the men. He should have a full appreciation of the high code of ethics which is instilled into our young officers at Annapolis and which, we are happy to believe, maintains an ever-strengthening influence as they pass up to the higher grades. Nothing has been so disastrous in its effect upon the Navy as the belief which has grown up during the past eight years, that the present Secretary never grasped the meaning of that phrase: "As an officer and a gentleman." Whether the charge is justly laid at his door or not, we leave it to the impartial judge of his record to determine for himself. On the other hand, the enlisted men must feel that they have in the Secretary a staunch friend, who stands ready at all times to safeguard their interests, promote their material comfort, and hold open the door of opportunity. In this last regard the Secretary has done good work.

Lastly, since not even the State Department is brought into a more intimate touch with the outside world than is the Navy, the Secretary should be a man of wide international outlook and free from petty traditional dislikes and prejudices. He should understand that it is possible for an officer to give generous praise in recognition of the work of an ally, without incurring suspicion that he is lacking in true Americanism. True Americanism stands for Mr. Roosevelt's "square deal." It believes that a demand for the recognition of the rights of the people whom the Navy safeguards, is compatible both with the full recognition of the rights of others and a frank acknowledgment of their achievements in a common cause.

Chess by Infants

CURRENT news relates the exploits of the eight-year-old Samuel Rzechewski, who has come out of Poland to conquer the world of chess. First-class players succumb to him; he gives simultaneous exhibitions against twenty average players with complete success; and Capablanca, at worst the world's second player, estimates that the United States may hold six men capable of giving him an even fight.

Chess has always been held up as the game of intellect par excellence; it has been taken for granted that only a rare combination of the highest mental abilities can qualify a man to play it with extreme skill. People who would realize that an infant prodigy in other lines is explainable on rational grounds are apt to be swept off the plane of common sense in discussing a Rzechewski or a Morphy.

The public at large and the mediocre player have little conception of the mental processes by which the masters of this game attain their results. Six years ago, in the Brooklyn-Washington telegraph match, one of the Brooklyn players undertook at about the twelfth move what appeared to be a highly hazardous sacrifice of a piece. A near-master in the gallery, a man whose journalistic activities are so heavy as to preclude his being among the very top-notchers of the game, spoke about as follows:

"That is the continuation employed by Blank against Dash at Hastings in 1896. In that game black defended so"—setting up the pieces on an idle board and running through the eighteen-year-old game from start to finish, never at a loss for the next move.

Turn from this scene to the rooms of the Manhattan or Brooklyn or Rice Chess Club, where we shall always find a gathering of the notable characters of metropolitan chess; and let us listen to the comments here made on a game in progress. Seldom do these comments take the form "If he goes here, black goes there; then white plays so and black so. . . ." Rather do we hear remarks like these: "But I tell you that *must* be strong—see the command it gives him of white's queen side"; or "Ach, he should have pushed the bishop pawn and built up his center"; or "What does he threaten? We have time for a developing move"; or "The isolated pawn ought to lose, in spite of the black king's being out of play."

The possible ramifications of any ordinary position in this game are well nigh infinite. Anderssen, one of the classical masters, in response to direct inquiry, said that when he was very fortunate he could see into the game as far as two moves. The good player does not analyze move by move, save in exceptional cases. His ability rests on two things. He remembers thousands of games that have been played by himself and others; thousands more of positions that are apt to be more or less closely approximated in actual play. He possesses the knack of putting out of his mind all other things when he is playing chess, and so doing he is able to master his memory and make it reveal to him in a flash the one game or the one position in all these thousands that throws light on the position before him. That is all there is to it.

Memory and attention do the trick. Memory is as likely to be found highly developed in a juvenile as in an adult. And once you get a juvenile with strong memory interested in chess, you have a strong player—for his experience gives him few things to conflict for attention with the board and men before him. All the amount of reasoning and analysis in the world are as nothing in the presence of the man who *knows* that in positions resembling this one the correct move is to occupy the open file with the rook or to post the knight on bishop's fourth, who can call to mind the complete course of a dozen games sufficiently similar to the present one to be a valid guide. That is the stuff of which chess prodigies, boy or man, are made.

Our Engineers and the Public Service

AT the signing of the armistice the question arose as to how far it would be possible to make permanent the war organization of the engineers of the United States and render it effective in times of peace; and, as a result of a call to assemble and debate the matter in Washington, there was an enthusiastic response, which resulted in the formation of the Federated American Engineering Societies.

That the underlying purposes of this great and influential body include no narrow or selfish aims is shown by the following extract from the preamble: "As service to others is the expression of the highest motive to which men respond, and as duty to contribute to the public welfare demands the best efforts that man can put forth, now, therefore, the engineering and allied technical societies of the United States of America, through the foundation of the Federated American Engineering Societies, realize a long cherished ideal—a comprehensive organization dedicated to the service of the community, State and Nation."

At a meeting of the Federated American Engineering Societies held on August 18 at Washington there was launched the American Engineering Council of the Federated Societies, which henceforth will voice the aims of the united engineering forces in furthering a great national program of public service. The program proposes the following activities:

To devote itself to the conservation of our national resources, particularly in coal, oil, timber and water power. It proposes also to apply itself, immediately, to the great national problem of transportation, not only by rail, river and ocean, but by various subordinate but rapidly developing means of transportation.

It will take hold of the question of industrial relations between capital and labor, a matter regarding which the engineer, because of his comparatively impartial point of view, is believed to be especially equipped to make recommendations. We may remark here that by virtue of his very position, he stands midway between the two elements which too often in the past have regarded each other with suspicion and distrust. The engineer of necessity has to be in close touch with capital. On the other hand, to be successful, he must have a sympathetic understanding of contractors, foremen and so-called common labor.

Another movement to which the Engineering Council will devote itself is that of the creation of a national public works department by means of a reorganization of the Department of the Interior. Here is another question on which, by virtue of thorough experience, the engineers of the country are peculiarly qualified to plan and advise. Of prime importance, also, is the recommendation that the Engineering Council should guide legislation in the matter of licensing and registration of engineers. In view of the magnitude and costliness of engineering works, and particularly in view of the degree to which public convenience and safety depend upon good engineering, we consider this matter of licensing and registration to be of fundamental importance. Under the present system, too many half-trained and ill-adapted young men are passed on into this profession, with results which are injurious to the public and to the engineering profession alike.

Not the least important work of the council will be to coöperate with the Drafting Bureau of Commerce in its work of preparing for a national budget system and other important legislation. No one is better qualified to make estimates of cost than the engineer, or so quick to throw out proposals of national magnitude which are visionary and doomed to ultimate failure.

That Parallel Postulate

The Dividing Line Between Euclidean and Non-Euclidean Geometry, and What the Latter Means

By The Einstein Prize Essay Editor

POINT, line and plane Euclid attempts to define. Modern objections to these efforts was made clear in our article of Sept. 18th. Against Euclid's specific definitions we urge the further specific fault that they are really assumptions bestowing certain properties upon points, lines and planes. These assumptions Euclid supplements in his axioms; and in the process of proving propositions he unconsciously supplements them still further. This is to be expected from one whose justification for laying down an axiom was the alleged obvious character of the statement made. If some things are too obvious to require demonstration, others may be admitted as too obvious to demand explicit statement at all.

Thus, if Euclid has two points A and B in a plane, on opposite sides of a line M, he will draw the line AB and without further formality speak of the point C *in which it intersects* M. That it does so intercept M, rather than in some way dodges it, is really an assumption as to the nature of lines and planes. Or again, Euclid will speak of a point D on the line AB, between or outside the points A and B, without making the formal assumption necessary to insure that the line is "full" of points so that such a point as D must exist. That such assumptions as these are necessary follows from our previous remarks. If we think of our geometry as dealing with x's, y's and z's, it is no longer in the least degree obvious that the simplest property applies to these elements. If we wish any property to prevail we must state it explicitly.

With the postulates embodied in his definitions, those stated in his axioms, and those which he reads into his structure by his methods of proof, Euclid has a categorical set—enough to serve as foundation for a geometry. We may then climb into Euclid's shoes and take the next step with him. We follow him while he proves a number of things about intersecting lines and about triangles. To be sure, when he proves that two triangles are identically constituted by moving one of them over on top of the other, we may protest on the ground that the admission of motion, especially of motion thus imposed from without, into a geometry of things is not beyond dispute. If Euclid has caught our modern viewpoint, he will rejoin that if we have any doubts as to the admissibility of motion he will lay down a postulate admitting it.

Having exhausted for the present the interest of intersecting lines, our guide now passes to a consideration of lines in the same plane that never meet. He defines such lines as parallel. If we object that he should show the existence of a derived concept like this before laying down a definition that calls for it to exist, he can show that two lines drawn perpendicular to the same line never meet. He will execute this proof by a special sort of superposition, which requires that the plane be folded over on itself, through the third dimension of surrounding space, rather than merely slid along upon itself.

We remain quiet while Euclid demonstrates that if two lines are cut by *any* transversal in such a way as to make corresponding angles at the two intersections equal, the lines are parallel. It is then in order to investigate the converse: if the lines are parallel to begin with, are the angles equal?

Axioms Made to Order

This sounds innocent enough; but in no way was Euclid able to devise a proof—or, for that matter, a disproof. So he took the only way out, and said that if the lines were parallel, obviously they extended in the same direction and made the angles equal. The thing was so obvious, he argued, that it was really an axiom and he didn't have to prove it; so he stated it as an axiom and proceeded. He didn't state it in precisely the form I have used; he apparently cast about for the form in which it would appear most obvious, and found a statement that suited him better than this one, and that comes to the same thing. But wisely enough, he did not transplant this axiom, once he had arrived at it, to the beginning of the book where the other axioms were grouped; he left it right where it was, following the proposition that if the angles were equal the lines were parallel.

This of course was so that it might appeal back to the demonstrated proposition for its claim to obviousness.

Euclid must have been dissatisfied with this cutting of the Gordian knot; his successors were acutely so. For twenty centuries the parallel axiom was regarded as the one blemish in an otherwise perfect work; every respectable mathematician had his shot at removing the defect by "proving" the objectionable axiom. The procedure was always the same: expunge the parallel axiom, in its place write another more or less "obvious" assumption, and from this derive the parallel statement more or less directly. Thus if we may assume that the sum of the angles of a triangle is always exactly 180 degrees, or that there can be drawn only one line through a given point parallel to a given line, we can prove Euclid's axiom. Sometimes the substitute assumption was openly made and stated, as in the two instances cited; as often it was admitted into the demonstration implicitly. But such "proofs" never satisfied anyone other than the man who made them; the search went merrily on for a valid "proof" that should not in substance assume the thing to be proved.

Locating the Discrepancy

Saccheri, an Italian Jesuit, would have struck bottom if he had had a little more imagination. He gave an exhaustive *reductio ad absurdum*, on the basis of the angle-sum theorem. This sum must be (a) greater than or (b) equal to or (c) less than 180 degrees. Saccheri showed that if one of these alternatives occurs in a single triangle, it must occur in every triangle. The first case gave little trouble; admitting the possibility of superposing in the special manner mentioned above, which he did implicitly, he showed that this "obtuse-angled hypothesis" contradicted itself. He pursued the "acute-angled hypothesis" for a long time before he satisfied himself that he had caught it, too, in an inconsistency. This left only the "right-angled hypothesis," proving the Euclidean angle-sum theory and through it the parallel postulate. But Saccheri was wrong: he had found no actual contradiction in the acute-angled hypothesis—for none exists therein.

OUR intuitions, if we give them free rein, will accept Euclidean geometry as the absolute truth about the space in which we are immersed. But in our article of September 18th we saw that no geometry can be the absolute truth about anything. The most that can happen is that a given set of objects, real or conceptual, constitute a realization of the geometry. To understand clearly the limitations of Euclid's geometry, we must go back and put ourselves in Euclid's shoes —as far as this can be reconstructed, in Euclid's very frame of mind. And let it be understood that the Euclidean geometry of this discussion is the scientific structure of a Euclid, a Klein or a Hilbert—not the pedagogic one of a Wentworth and a Smith with which most of us are better acquainted.—THE EDITOR.

The full facts were probably first known to Gauss, who had a finger in every mathematical pie that had to do with the transition to modern times. They were first published by Lobatchewsky, the Russian, who anticipated the Hungarian John Bolyai by a narrow margin. All three worked independently of Saccheri, whose manuscript turned up only in recent years.

Like Saccheri, Lobatchewsky investigated alternative possibilities. But he chose another point of attack: through a given point it must be possible to draw, in the same plane with a given line (a) no lines or (b) one line or (c) a plurality of lines, which shall not meet the given line. The word parallel is defined only in terms of the second of these hypotheses, so we avoid it here. These three cases correspond, respectively, to those of Saccheri.

The first case Lobatchewsky ruled out just as did Saccheri, but accepting consciously the proviso attached to its elimination; the third he could not rule out. He developed the consequences of this hypothesis as far as Euclid develops those of the second one, sketching in a full outline for a system of geometry and trigonometry based on a plurality of "non-cutters." This geometry constitutes a coherent whole, without a logical flaw.

This made it plain what was the matter with Euclid's parallel axiom. Nobody could prove it from his other assumptions *because it is not a consequence of these.* True or false, it is independent of them. Trinity Church is in New York, Faneuil Hall is in Boston, but Faneuil Hall is not in Boston *because* Trinity is in New York; and we could not prove that Faneuil Hall was in Boston if we knew nothing about America save that Trinity is in New York. The mathematicians of 2,000 years had been pursuing, on a gigantic scale, a delusion of *post hoc, ergo propter hoc.*

What the Postulate Really Does

Moreover, in the absence of an assumption covering the ground, we shall not know which of the alternatives (a), (b), (c) holds. But when one holds in a single case it holds permanently; so we cannot proceed on this indefinite basis; we must know which one is to hold. Without the parallel postulate or a substitute therefor that shall tell us the same thing or tell us something different, we have not got a categorical set of assumptions—we cannot build a geometry at all.

The reason why it took so long for this to percolate into the understanding of the mathematicians was that they were thinking, not in terms of the modern geometry and about undefined elements; but in terms of the old geometry and about strictly defined and circumscribed elements. If we understand what is meant by Euclidean line and plane, of course the parallel postulate, to use the old geometer's word, is true—of course, to adopt the modern viewpoint, if we agree to employ an element to which that assumption applies, the assumption is realized. The very fact of accepting the "straight" line and the "flat" plane of Euclid constitutes acceptance of his parallel postulate—the only thing that can separate his geometry from other geometries. But of course we can't prove it; the prior postulates which we would have to use in such an attempt apply where it does not apply.

To all this the classical Euclidean rejoins that we seem to have in mind elements of some sort to which, with one reservation, his postulates apply. He wants to know what these elements look like. We can, and must, produce them—else our talk about generality is mere drivel. But we must take care that the Euclidean geometer does not try to apply to our elements the notions of straightness and flatness which inhere in the parallel postulate. We cannot satisfy and defy that postulate at the same time. If we do not insist on this point, we shall find that we are reading non-Euclidean properties into Euclidean geometry, and interpreting the elements of the latter as straight lines that are not straight, flat planes that are not flat. It is not the mission of non-Euclidean geometry thus to deny the possibility of Euclidean geometry; it merely demands a place of equal honor.

The Geometry of Surfaces

Let us ask the Euclidean geometer whether he can recognize his plane after we have crumpled it up like a piece of paper en route to the waste basket. He will hesitate only long enough to recall that in the special case of superposition he has reserved for himself the privilege of deforming his own plane, and to realize that he can always iron his plane out smooth again after we are through with it. This emphasizes the true nature of the two-dimensionality which is the fundamental characteristic of the plane (and of other things, as we shall directly see). The plane is two-dimensional in points *not* because two sets of mutually perpendicular Euclidean straight lines can be drawn in it defining directions of north-south and east-west, but because a point in it can be located by means of two measures. The same statement may be made of anything whatever to which the term "surface" is applicable; anything, however crumpled or irregular it be, that possesses length and breadth without thickness. The surface of a sphere, of a cylinder, of an ellipsoid, of a cone, of a doughnut (mathematically known as a torus), of a gear wheel, of a French horn, all these possess two-dimensionality in points; on all of them we can draw lines and curves and derive a geometry of these figures. If we get away from the notion that geometry of two dimensions must deal with planes, and adopt in place of this idea the broader restriction that it shall deal with surfaces, we shall have the generali-

(*Continued on page 579*)

Illiterate Adults

Our Growing Population That Reads and Writes in Other Languages or None at All

By Winthrop Talbot, M.D.

IN this country each year a million boys come to be 18 years of age. One hundred thousand of them have never had any schooling at all. They are technically illiterate. Illiteracy may be defined as inability to read or write in any language, and this definition applies throughout the following article. It should be understood that statistics of adult illiteracy deal only with persons who are over 14 years of age and who are beyond the obligatory school age. In addition to the one hundred thousand technical illiterates, two hundred thousand more have not had more than two years of schooling or three hundred and twenty days and about half of them have had but one year or 160 days of attendance at school. These two hundred thousand boys are practically illiterate for they have left school so young that as men they have retained but little of their schooling. More than half of the million barely reach the sixth grade, and a scant hundred thousand ever get as far as high school.

Men unable to read or write in any language, receiving instruction at the expense of their employer

Nineteen States do not require the full school year of 200 days. Eight States require less than one hundred days. The average school year is only 163 days. One State has failed until now to make any schooling obligatory.

Less than ten per cent of all males get any kind of vocational or trade training at school. Fifty thousand of our million 18-year-olds do not speak any English at all. Among the million youths physical defects are general, due in large measure to ignorance. Two hundred thousand of the million would be rejected as unfit to serve the country because of extreme physical, moral, or mental defects. We certainly cannot congratulate ourselves upon any alarmingly high standards or effective results in our schooling of youth in America thus far.

How is it with our foreign adults and negroes and native whites? In 1910 we had five and a half million (5,516,163) persons who could not read a word in any language. Of these a million and a half were foreign-born. Now in 1920 we have nearly two million and a half illiterate aliens who cannot read a word even in their own languages. For example, from 1910 to 1914 inclusive, we admitted 971,366 immigrants from southern Italy and of these 415,806 or 49 per cent could not sign their names or read even the simplest Italian words. These are technical illiterates, but almost all Armenians, Turks, Russians, Bulgarians, Ukrainians, Croats, and Yiddish speaking peoples come practically illiterate to America, even though they may be able to read and write in their own languages, because their script and printed letter forms are quite different from ours.

The near-illiterate or those who can barely write their names and who decipher words only with difficulty are nearly four times as numerous as the technically illiterate. If now we take into consideration our negro population and unschooled native whites, it is easily grasped that in our total population we are all seriously handicapped by the intellectual dependency and mental pauperism of one quarter of our American population. This vast number, more than twenty-five millions, is cut off from ability to share properly in our national life. They form the drag on labor. They contribute mainly to our defective and criminal classes. They are the "examples" of our radical agitators.

Seventy per cent of industrial accidents occur to persons who require the services of an interpreter in presenting their claims. In most cases those who are injured are unable to read even a danger sign. In New York State alone from 1915 to 1918 accidents in industry have averaged 274,763 annually. In other words the number of industrial accidents averaged more annually than the total casualties of the American Expeditionary Force. The figures are as follows: 1915, 225,391; 1916, 273,385; 1917, 313,406; 1918, 286,871. At present industrial accidents are reported at the rate of approximately a thousand a day every working day in the year in this one State. This represents an initial expenditure of $13,000,000 a year for compensation. If we add to this the cost of medical benefits, administration of the compensation law, wages and cost of turnover, the total is about $25,000,000 yearly or $80,000 a day for accidents only to those who do not understand the American language.

This is the accident cost of the illiterate in this one State alone. What is true of the State of New York is also true of the whole manufacturing belt of the North, as well as of mining States such as West Virginia, Colorado, and Idaho. Thus a quarter of a million dollars a day is a moderate estimate of the cost of the illiterate to industry in the United States for accidents only, due in large measure to inability to read a danger sign or to understand ordinary safety instructions, and because of lack of a common language.

It is generally known that steel and coal strikes with their attendant loss of production and wage, as well as strikes occurring in other industries employing large numbers of foreigners are fomented readily because of inevitable misunderstandings due to diversity of speech. In many industrial plants twenty or more races of men are employed speaking as many languages, unable to read common work notices, and thus incapable of ready assimilation or industrial teamwork.

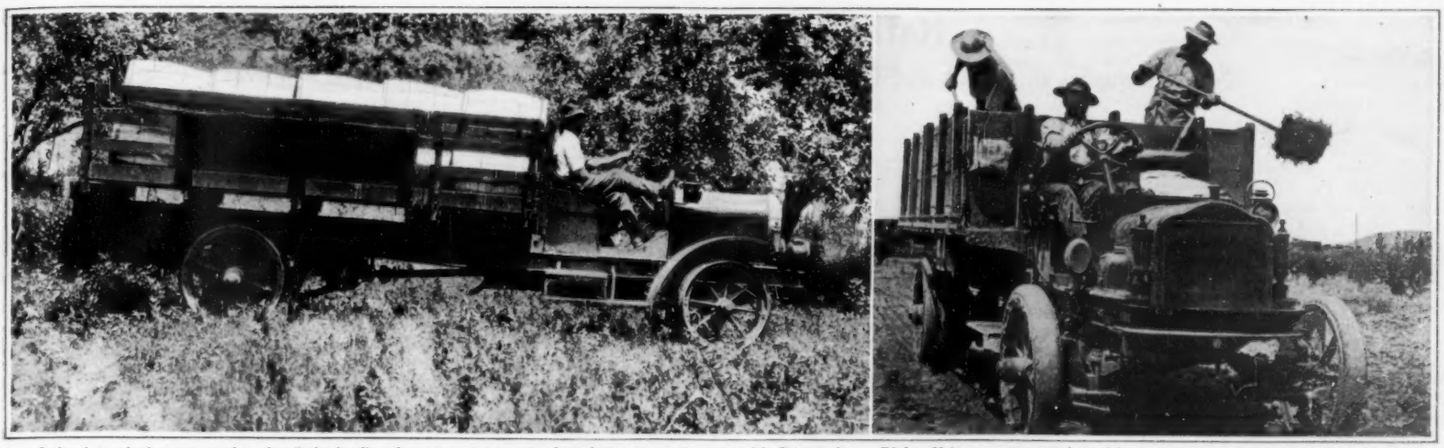
During the fifteen years from 1900 to 1914 inclusive, the total number of immigrants to the United States beyond school age, that is, over 14 years of age, was nearly twelve million (11,726,606). Of this number more than three million (3,116,182) could not decipher a word in their native tongue and practically all

(Continued on page 580)

THE tremendously increased opportunities for acquiring the rudiments of an education today, as compared with a century ago, more or less, are apt to blind us to the necessity of some steps that shall insure the utilization of these advantages by the maximum proportion of the population. We take it for granted that everybody can and therefore that everybody does learn to read and write. The experience of those in charge of the great draft-act administration was perhaps the first suggestion that there exists in our midst a body of men and women aggregating ten per cent of the whole who can not read or write in any language. Dr. Talbot, as the author of several Federal bulletins on the situation and one who has dealt with it in public schools and industrial plants, is well qualified to tell us the extent and seriousnesss of this problem.—THE EDITOR.

Standing: Serb, Swede, Bohemian, Slovene, Slovak, German, Lithuanian, American Negro. *Sitting:* Russian Jew, German Pole, Russian Pole, Austrian Pole, Italian, Greek

A representative group, not selected, from a Workers' Public School in a tannery. Fourteen men of fourteen races, unable to read English



Left: A truck that was used to do all the hauling for a mountain orchard, and that came through with flying colors. *Right:* Using a motor truck to deliver manure to the point of final deposit

Two of the many tasks which a motor truck can perform cheaply and efficiently for the orchardist

Motor Trucks in Orchards

By Arthur L. Dahl

NATURE is slow in growing to maturity fresh fruits, but once they have reached that state of perfection they deteriorate more or less rapidly, and the greatest task of the orchardist is in marketing his fruit crop in the quickest possible time and with the least amount of spoilage.

The time of harvest for most fresh fruits is limited to a month or so, and the most bountiful crop will not put dollars in the bank unless the fruit is delivered to a buyer in good condition; and in aiding the fruit grower to harvest all of his crop and make delivery to the purchaser in the best possible condition, the motor truck is playing an important part in all sections of the country.

In modern times a large proportion of the fruit grown in many sections of our country is sold to canneries, and these canneries have very strict and rigid standards for fruit, and the prices paid for deliveries made by orchardists are based upon those standards. In too many cases fruit growers living some miles from the cannery have left home with a load of fresh fruit in good condition, but on account of the heat of the sun and the length of time required to reach the delivery point with a team, the freshness of the fruit was largely lost and the owner was severely penalized for this condition. Now this orchardist may have devoted as careful and intelligent attention to the production of that fruit crop as any of his neighbors, but because his transportation facilities were slow and inadequate, he suffered the loss of a large share of the profit he should have had.

The first point of superiority of trucks for orchard use is speed in making deliveries. A truck, even though loaded to capacity, can make better time than horse-drawn vehicles, and in the movement of a large tonnage of perishable fruit, this might mean the handling of double the amount of fruit in the same time, compared to horses. The saving in time in making deliveries is in proportion to the distance hauled, for the longer the haul the more time saved, for the truck can maintain a steady speed over the entire distance and keep it up for many round trips, while horses naturally tire.

As an example of the time saved in using trucks for delivering fruit the following experience was related by one of the owners of the Harrison Nurseries, of Berlin, Md.

"We use our trucks in transporting fruit, particularly peaches, from orchards to our packing plant. Peaches must be handled quickly, and it is also important that we make our schedule with the railroads. At packing time we employ from 100 to 125 people, whose work is directly dependent upon our trucks. Recently one of our motor trucks enabled us to transport a force of men from Berlin to Easton, 75 miles away, pick $16,000 worth of peaches and return in six days. Another of our trucks this season made thirteen trips in one day between one of our orchards and our packing plant, a distance of two miles, carrying 175 baskets of peaches on each trip, besides two other trips carrying employees."

Another peach grower reported that in the old days when he used a team he had to start for market, 10 miles away, between 12 and 2 A. M. and got back toward noon. The trip with the wagon had to be very slow to prevent bruising. Now, however, with an auto truck equipped with good springs, shock absorbers and pneumatic tires, the most delicate peaches are carried into market within an hour, and other stuff in half the time. He starts out at 5 A. M., is unloaded at market by 6, and is back at the farm a little after 7, with the whole day ahead of him for other work.

Motor trucks not only enable the fruit grower to haul his crop in less time, but he can haul a great deal more to a load than with any other mode of conveyance. This means that in many cases the truck will handle in one load what would have been two or more loads with a team, and in this day of labor shortage this is an important advantage.

California is a great fruit country, and there are some very good roads there, so it is to be expected that motor trucks should readily demonstrate their carrying capacity there to the best advantage. There are hundreds of examples of enormous loads of fresh fruit hauled from one point to another in California, but a representative one is the experience of a Santa Clara orchardist who hauled, on a motor truck and a trailer, 16,000 pounds of fresh apricots from his orchard to the cannery, a distance of six miles. A part of this haul was made over the soft ground of an orchard before the county road was reached, but this outfit operated throughout the picking season and never gave any trouble.

Throughout the various fruit districts of California motor trucks can be seen engaged in doing all kinds of work from hauling manure to fertilize the soil to hauling the fruit crop to market. Many owners have several types of bodies for their trucks, so that they can

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Cover Crops for Our Orchards

By H. A. Crafts

THE use of cover crops in California orcharding is very important to successful culture, and its value is being better appreciated the more it is practiced. Climatic conditions are among those entering into the problem. The rainless summers of California render conservation of moisture very essential to the production of any crop whatever. And it is just as essential to a full fruit crop as to any other.

Cover crops may be made to conserve moisture in more than one direction.

Shading, mulching, and cultivation may be mentioned as being among these.

The benefits of cultivation, of course, accrue automatically. You cannot very well raise a cover crop without first plowing the ground, harrowing, cultivating, disking it; and all this stirring of the soil tends strongly to conserve moisture. Well-plowed and cultivated ground lies in the best shape possible to receive, retain and distribute the moisture resulting from current rainfall. It also stimulates the rise of the hidden moisture, stored in the sub-strata of the soil. Thus it aids the accumulation of necessary moisture from two opposite directions, and thus seems to exercise a most valuable and well-ordered function.

Again, a cover crop provides a very feasible method of refertilization. For the crop, in its state of fullest maturity, may be plowed under, and made to supply that very necessary substance to the soil, known to science as humus, but which in plain, unvarnished English means simply vegetable matter in process of decomposition.

The ancient illusion under which some orchardists labor, even at this late day, that a fruit tree that once germinates, springs up, flourishes and produces fruit, is a permanent institution; and that the principal duty of the orchardist is simply to harvest a crop of fruit, year by year, from these permanent trees, seems to be slowly vanishing from pomological psychology. The truth of the matter is that the fruit tree should be nursed and nourished and fostered even much more faithfully than a mere annual crop of corn, or potatoes or beans. This because the fruit tree stands guard ceaselessly, night and day, summer and winter, in sunshine or rain, being exposed to the constant play of the elements, the assaults of disease and pestiferous insects, and so forth.

The life tenure of the peach tree, the orange tree, or the plum tree is perennial, while that of the stalk of corn is only annual. The stalk of corn germinates, takes root, springs up and flourishes only through the brief period of a seasonal career. About September it has finished its cycle; the farmer comes along with a corn cutter, and the whole life of that stalk ceases, save in the golden kernel which it bestows upon the

(*Continued on page 582*)

A gang of moldboard plows at work in a California orchard, preparing the ground for a cover crop that conserves the moisture and furnishes a rich supply of fertilizer when ready to be plowed under

A Railroad to Hudson Bay!

New Resources in Wheat and Copper That Are Expected to Contribute to Its Support

By Anthony M. Rud

Rebuilding the bridge at Armstrong Lake, destroyed by storm

TWO lines of steel are piercing the heart of the Land of Lobstick and Lode, that musky wilderness stretching north from the Saskatchewan River which since the advent of the white man in the seventeenth century (1670, reign of Charles) has been sacred to Esquimaux, Indians, trappers and traders. The railroad, starting from Le Pas at the junction of the Saskatchewan and Opasquai Rivers, already has driven 359 miles northeastward. Eighty miles more of track, which will be completed before midsummer of 1921, will reach the northern terminus at York Factory (Port Nelson) on Hudson Bay.

A "chechako" in the fullest sense of the word, I have just returned from a journey along this new road, and a trip by paddle and portage over the portion of the right-of-way yet incomplete. If it were not for two very definite reasons I should consider the enterprise the acme of the Quixotic, for no more wild and desolate wilderness exists anywhere between Fort Good Hope (Arctic Circle, long. 130) and Winnipeg, between Halifax and Prince Rupert.

A Canadian wizard of wheat recently has added, to the striking achievements of inventing Kitchener wheat, Improved Marquis, and several lesser varieties, an absolutely new variety of red wheat known as Red Top. With Red Top he has established a world's record of 84 bushels to the acre on his quarter-section experimental farm near Prince Albert, Saskatchewan. This is not the most important quality of Red Top wheat, however, nor is the fact that red wheat always has been the favorite of the flour millers. Red Top matures from ten to fifteen days before Kitchener, Marquis, or any other northern wheat!

The significance of this may not be apparent at first glance to the non-agriculturist, but the story is brief. Frost draws a very definite line in the matter of grain cultivation. One cannot grow wheat north of the line where frost appears before the crop is ripe. Red Top, maturing an average of twelve days earlier than any other variety of wheat, pushes northward the boundary of Canadian wheat lands by at least 125 miles! As wheat is practically the only important crop of northern Canada, it is manifest that the addition of 200,000 square miles or more of fertile land to that territory raising the world's food supply, is a matter transcending in importance what Italy does in regard to Fiume, what the Japanese and Californians decide about immigration, or what the trend of United States' policy in regard to the League of Nations becomes under the new administration. The world must eat.

The relation of this discovery—the result of seven years of continued experiment—to the new Hudson Bay Railway, becomes immediately apparent. For a decade export wheat has been tied up, and made unprofitable at Montreal because of car shortages, vessel shortages, and the piling up of demurrage charges. The Canadian Government, in building the new road from La Pas to Port Nelson is planning to ship *via* Hudson Bay all of central and western Canada's wheat destined for export, thus relieving forever the congestion and obviating the delay. Wheat from the old areas—not even considering that which will be grown on the new 125-mile zone—will be shipped at a saving of from six to fifteen cents a bushel. Seven cents will be the lowest saving on Red Top in the added wheat area.

The figures are plain. The new route will save—outside demurrage charges for delay—the cost of shipping 547 (net) miles from Winnipeg, 650 miles from Regina, 685 miles from Brandon, 1,188 miles from Edmonton, and 1,311 miles from Prince Albert. Each of these cities ships more wheat than all other commodities combined. In the present time of freight car shortage it is not necessary to dwell upon the importance of having thousands more of cars at the disposal of the public; this means the erasing at one sweep of dozens of transportation tie-ups and alibis.

The new wheat zone *must* ship *via* this route, as the net saving in distance varies from 100 to 225 miles more than that mentioned in the above figures.

If the new railroad had no other mission it would be of immense importance. As a matter of fact, however, it opens a means of transportation for ore to one of the richest mineral districts in the world.

Herb Lake, Schist Lake and the Flin-Flon region are merely three of a dozen copper, silver and gold properties that are producing right now in prodigal fashion. While the gold and silver as yet have not been discovered in quantities that fade out the Yukon and Cobalt districts, they are being mined with great profit.

Some of the world's richest copper mines, however, lie in the Flin-Flon district. In the States they talk with awe in their voices of Anaconda and other properties which yield from 1.25 to 6 per cent copper ore. *There exist today a half-dozen mines north of Le Pas which are producing ore that yields from 18 per cent upward!* The record, so far as I know, is 21.4 per cent, but the probability is strong that the future will produce even greater yields.

True, there has been grave difficulty with the disposal of mined ore. So far it has been carted overland to Trail, British Columbia, for smelting, and thence clear to Elizabeth, New Jersey, for refining and sale. The new railway, however, will cut out at one swoop half of the expense. A fair fraction of the remainder will be done away with in two years, when smelters and refining plants are erected.

THE enthusiastic Canadian map-maker has for some years drawn on his charts a dotted line representing a railroad "projected" to give the great inner stretches of the Northwest Territories an outlet to Hudson Bay. But those of us who visualize the northern half of Canada as a land of almost perpetual winter, and Hudson Bay itself as choked with floating icebergs, have always found it difficult to take this "project" seriously. Mr. Rud does not try to disabuse us of any mistaken notions we may have had regarding the summer climate of Canada and the navigability of Hudson Bay—he probably feels that if we don't know about these things we ought to. He does tell us, however, a few things that are news because they are really new, and that have a very large bearing upon the probability of successful operation of the road that is now actually being built to the shores of Hudson Bay.—THE EDITOR.

1. Starting a portage at Grand Rapids, with the only resident horse north of 55°. 2. A grading difficulty at the present end of the line, Mile 359, north of Le Pas, where the embankment gave way beneath a locomotive. 3. Taking advantage of a breeze on the Nelson River to complete the last lap of the journey to tidewater under present conditions.

Some glimpses of the country through which the Hudson Bay Railroad will go

Boating Without Oars

FROM Germany comes the accompanying photograph, showing a new method of propelling a rowboat. Instead of the conventional oars, this boat is provided with an elaborate system of levers terminating in paddles. By working a lever back and forth, these arms cause the paddles to push the boat along. The paddles may be worked by child or adult, and the operator may sit facing forward or backward, according to his or her preference in the matter.

Copyright Kadel & Herbert

Working the hand lever back and forth propels this boat along at a good clip

A New Deal for the Monoplane

AS far as the large passenger-carrying airplane is concerned, the idea that the biplane is the only satisfactory type has been permitted to go unchallenged in most countries. Monoplane design for small, fast machines and biplane design for the large, slow machines, has been the general formula.

But we have not reckoned with Herr Fokker of wartime fame. This veteran Dutch builder of Germany's best fighting machines now comes forward with a passenger carrier of monoplane design which is just as different from anything else as we would expect from a man who has always arrived at his remarkable results in his own individual way. The latest Fokker creation, which is shown in the accompanying illustration, is the type "F-11," built in the new Fokker works at Amsterdam. This machine is one of two monoplanes to be used on the Amsterdam-London air service, which will ultimately be linked up with the service to Bremen, Hamburg and Copenhagen.

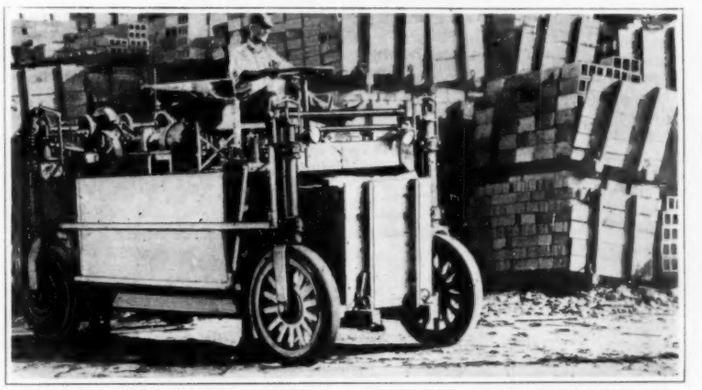
The machine is a monoplane of the cantilever type, with a wing that is very thick in the center and tapers toward the tips. The covering is of three-ply wood, which, if not too heavy, should prove very serviceable in this instance. The large wing is placed on the roof of the cabin, and is held in place by four bolts only, one on each side at the top longeron, and at the apex of each set of three struts running from the bottom of the fuselage. Balanced ailerons of small area are fitted to the tips of the wing.

The plane carries six passengers in the passenger cabin, which is entirely enclosed, while a seventh is carried in the pilot's cockpit in front of the cabin. The power plant consists of a 185-horse-power engine driving a tractor screw. At present the maximum speed is about 90 miles per hour, while the cruising speed is about 75 miles per hour. The tank capacity is such as to give the machine an endurance of ten hours at cruising speed, with which amount of fuel there will still be sufficient disposable lift to carry pilot and four passengers. In a recent flight from Amsterdam to London this machine traversed the distance in three hours and consumed less than 30 gallons of fuel. This is an economical performance and speaks well for the commercial possibilities of Fokker's peacetime carrier.

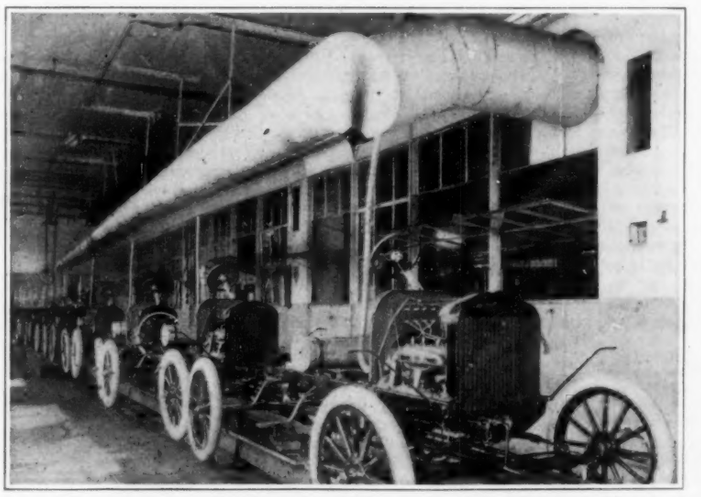
Fokker's latest creation—a six-passenger-and-pilot monoplane for use between Amsterdam and London

A New Thought on the Handling of Bricks

AT last we have with us a machine that bids fair to cut building costs. It will save the work of many men and effect big savings in materials that have heretofore been wasted. This carrier was originally designed to cut handling costs in the lumber industry. As such it proved a big success. Such machines are driven by one man sitting on top, from which position he controls all movements. In the lumber yard or mill, the carrier runs over a load of big timber, placed on blotters, picks up the load automatically in a few seconds, and is off again at a ten-mile-an-hour gait to any part of the yard. On reaching its goal it drops its load just as quickly.



Lumber-carrying truck doing service as a carrier of heavy brick



The carbon monoxide fumes from these automobiles are removed by the suction system overhead

Recently four of these carriers were placed in service by a southern brick company for a most unusual way of handling brick. As such they have proved a marked success. Each of these machines loads itself and carries and discharges automatically 2,000 bricks or nearly 5½ tons to the load, without breaking a single brick, and with a competent operator will pick up or discharge a load in less than eleven seconds.

The brick is located about thirty-five miles across Lake Pontchartrain from New Orleans. These bricks or tiles are placed in crates, 1,000 to a crate at the kiln or plant, after which they are picked up by the carrier which straddles two of these crates and brings them down to the wharf where they are loaded in barges by means of steam cranes. They are removed in the same manner at the brick wharf in New Orleans.

From the wharf they are again picked up by the carriers and deliveries are made by them direct to the buildings under construction without removing the bricks from the crates or rehandling in any way. Aside from the labor-saving feature and faster deliveries, contractors prefer to have the bricks delivered by these carriers as the loads are placed in neat piles at the building and do not take up so much street room. Another very important feature is that the loss sustained through breakage in having trucks dump the bricks in the street has been practically eliminated. In many instances these crates are hoisted to the floors on which bricklayers are working, instead of by the familiar hod-carrier method. As each crate contains a thousand brick, one can readily picture the convenience and savings which this new method of handling accomplishes in the brick and building industries.

Artificial Wool from Cotton Waste

ANNOUNCEMENT has been made that a process has been discovered by which artificial wool can be produced from cotton waste. The basis of the artificial wool is cellulose acetate, and the material is claimed to be an even better insulator against heat and cold than ordinary wool to wear equally well, and to take with equal success a dye of any desired color.

The new material has, it is understood, been subjected to severe tests by the textile department of the Leeds (England) University, where it has been successfully converted into fabrics. Cloth was woven with a mixture consisting half of artificial wool and half of natural wool, the product resembling tweed. The cloth, according to Prof. A. F. Barker, head of the department concerned, would prove serviceable for men's wear or for wear by women who fancy cloth resembling homespun.

Prof. Barker declares that artificial wool will have results corresponding to those of artificial silk, but pure wool will not be ousted from the market any more than pure silk has been. It cannot be assumed that people will prefer fabrics of artificial wool to those of natural wool. The artificial wool, however, should be much cheaper than natural wool, and it may be found to have wearing qualities which will commend it to the workers. The *Overseas Daily Mail* states that it is recognized that the new product has certain limitations, one of which is its liability to break and its inelasticity. Owing to this it may not at present be possible satisfactorily to use it in the production of yarns on the worsted principle, for which purpose it is necessary for yarn to possess a uniforming combing length of 2 inches or more. Where short fibers can be employed, however, such as in woolen yarn and cloth manufacture, it may prove serviceable.

Keeping the Automobile Exhaust Under Control

THE dangers arising from inhaling carbon monoxide gas, even in greatly diluted form, have been pointed out so often and so strongly of late that they are a matter of common knowledge. It is well known that an automobile, operating in a closed garage, generates dangerous fumes which are apt to prove fatal to those working in such close confinement.

With these facts so well established, we can turn to the accompanying view with a greater sense of appreciation for what one of our leading automobile manufacturers has done. Here is the final assembly line where the automobiles are given an engine test. To protect the health of the workers, specially-constructed pipes are attached to the motors and rise to join the suction system above in the manner of trolley poles. The pipes connect with the suction system by means of soft rubber strips which form a flexible channel, as shown. In this manner a satisfactory connection is effected.

Items In Brief

A Department Devoted to Current News in All Fields of Pure and Applied Science

Power and Fuels

Natural-Gas Gasoline.—The natural-gas gasoline industry has made large contributions to the supply of motor fuel and has achieved remarkable advances since its beginning. In increasing the supply of motor fuel natural-gas gasoline is a direct means of conservation in that its extraction does not destroy the gas in which it is contained. Experiment has demonstrated that the extraction of gasoline from natural gas does not reduce appreciably the value of the gas for heat, power, and light, but that it is a benefit, for it removes not only the water but also the gasoline, which causes leakage by disintegrating the rubber gaskets in the pipes. Statistics covering the eight years from 1911 to 1918, inclusive, show that an estimated volume of 1,145,113,000 cubic feet of natural gas was treated during that time in the manufacture of gasoline and that the total quantity of gasoline obtained was approximately 755,497,000 gallons. After finishing this supply of gasoline, the natural gas treated was sent through transmission lines to distributing companies or direct to the consumers and utilized for fuel and light. The industry may therefore be compared favorably with the carbon-black industry, in which the natural gas is destroyed.

Chinese Coal.—According to A. M. G. Grant, a consulting mining engineer who recently returned to Great Britain, 100,000 tons of coal have been shipped as an experiment from China to Newcastle-on-Tyne. It is said that the coal is "of excellent quality, and, imported in larger quanties, could be sold at cheaper rates than British." All of which is certainly strange!

The Fallacy of the Smokeless Chimney.—Year after year we have been taught to consider the smokeless chimney as a symbol of furnace economy. Yet along comes J. T. Beard in a recent issue of *Power*, with the bald announcement that in a coal-burning plant a stack that is smokeless all day indicates excess of air supply. The author points out that the loss due to unburned combustible in smoked chimneys is probably not more than 1 or 2 per cent of the heat in coal and this is more than balanced by the loss due to excess air in the smokeless chimneys. The real objections to smoke are: First, the sooting of heating surfaces, and this trouble can be taken care of with soot blowers; second, interference with the health and comfort of the community. Mr. Beard concludes that in a well-designed plant it is possible to have a smokeless stack as well as economical plant by providing proper combustion space and correct furnace design.

Something New in Steam Generators, known as the Blomquist steam generator, is described in a recent issue of *Electrical World*, in the form of an abstract from the German technical press. The generator in question is a boiler, or high-speed steam generator, of a radically new type, which has been put in operation in a Gothenburg mill. The boiler consists of 11 pressed steel cylinders of 12-inch diameter and 8 feet heated length, which are rotated at the rate of 375 r.p.m. Due to the centrifugal action the water will cover the entire inner surface of the tubes, keeping the temperature of the steel below 300 deg. C. The tubes are supported in ball bearings, feed water being injected at one end and steam taken out at the other, through steam-tight boxes. The generator produces 13,000 lbs. of steam per hour at 50 atmospheres or 740 lbs. per square inch. This steam generator may be used to increase the pressure in existing plants, where high-pressure turbines can be employed to utilize the increase in boiler capacity thereby obtained.

Automotive Progress

Britain's Motor Signals.—It is reported that it will "shortly be made compulsory" for uniform road signals to be used by drivers of all vehicles in Great Britain. "The signals are to be made by either the arm in the case of right-hand-drive cars, or by a mechanical arm in the case of left-hand-drive vehicles," and, as a commencement, they will comprise: Raised arm, "Stop." Horizontal arm, "Turn to the right." These signals must be given from the right-hand side of the car. In London additional signals will be brought into use. It is added that the use of the left-hand-drive car may be affected. "Although the actual type of mechanical signal necessary in this case has not yet been selected, it will probably be found more convenient to use cars fitted with the right-hand-drive than to install a device which cannot for some time be reliable." In interpreting all this, we must of course remember that Britain keeps to the left.

Automobile Bodies by Electro-plating.—In a recent issue of the *Automobile Engineer* there is described a novel process for making metal panels for automobile bodies. The process is an electrolytic one, in which a mold is provided of the desired profile and is rendered electrically conductive; also a member which operates with it in such a manner that when placed together they form the walls of a vat, and constitute the anode and cathode members. When electric deposition is completed, the finished article is removed from the pattern, and the operation can again be repeated upon the latter. One wall of the vat is made of the metal which it is required to deposit, and it is insulated from the cathode member. Special means are provided to secure an even deposition of the metal; the vat is sealed and an upper tank is provided to contain the electrolyte, a constant vigorous stream being maintained.

Our Motor Fuel Situation.—The number of automobiles in service increased about 1,700 per cent from 1909 to 1918, while the production of gasoline increased 560 per cent, and the production of crude oil only 95 per cent, according to the Bureau of Mines. Because of the great demand for kerosene, it is unlikely that the quantity of gasoline can be increased by making it less volatile than now. The extraction of gasoline from natural gas is approaching its maximum. The supply of fuel oil from which gasoline may be obtained by cracking is sufficiently large, although the demand for fuel oil has increased rapidly and the price has more than doubled, but the process of cracking is expensive and would be unprofitable without a further increase in the price of gasoline. The use of alcohol as a motor fuel will probably increase, as well as the use of benzene produced from coal tar.

Pure Science

The International Congress of Mathematicians, which recently met in Strassburg, decided to hold the next congress in New York in 1924.

A Remarkable Coal Mining Laboratory has been installed under the science and engineering building of the Carnegie Institute of Technology at Pittsburgh. The laboratory comprises a full-size coal mine, a mine locomotive and a complete set of coal and metal mine machinery, furnished by various manufacturers.

Agricultural Experiment Stations in Alaska.—The U. S. Department of Agriculture maintains five agricultural experiment stations in Alaska; viz., at Sitka, Kodiak, Matanuska, Fairbanks and Rampart. The last named is just under the Arctic Circle, where the temperatures range from 88 above to 63 below zero Fahrenheit. These stations, says an announcement from the department, have done considerable work in breeding and establishing new varieties of grains, berries, fruits and other economic plants suited to the short season of growth, and have also promoted the raising of domestic animals, of which there is great need in Alaska on account of its remoteness from the rest of the world. At present the largest farming settlement is in the vicinity of Fairbanks, in the Tanana Valley, raising 5,000 bushels of grain in 1919.

The Death of Dr. Margules.—Mr. Fitzhugh Talman's appeal in behalf of the Austrian meteorologists, recently published in our correspondence column, is reinforced by the statement that has appeared in the London *Times* that Dr. Max Margules, well known for his brilliant contributions to dynamic meteorology, died of starvation in Vienna on October 4. A warm tribute is paid to Margules in a current number of *Nature* by Dr. Ernest Gold, of the British Meteorological Office. Margules published in 1892 and 1893 a series of masterly papers on the motion of air on a rotating spheroid, and in 1903 he published a remarkable memoir on the energy of storms. In recent years he had retired entirely from meteorological work and up to the time of his death had been striving to live on a pension of 400 crowns a month, which is equivalent to less than two dollars. The American Meteorological Society is raising a fund in behalf of the meteorologists of Austria and their families, and has already begun to remit food drafts. Contributions can be sent to the secretary of the society, Dr. C. F. Brooks, U. S. Weather Bureau, Washington, D. C.

Transportation

How Railroads Handle Coal.—The Norfolk & Western Railway Company has contracted for another car dumper which will have a tremendous capacity. This machine will take the largest road cars and overturn them into specially designed motor-driven transfer cars having power-operated bottom gates through which the coal will be distributed to the lines of coal-loading bins on the piers. The vessels coming alongside the piers will then be loaded rapidly by gravity with breakage of the coal reduced to the minimum. Mechanical trimmers, which effect a wonderful saving by eliminating hand trimming, will be used. Could the road cars be supplied without interruption, this machine alone would have a capacity for loading into boats over 8,000,000 tons of coal per year when operated for eight hours during each working day. This represents 1,440 ocean-going vessel cargoes.

Fuel Oil for Locomotives.—At the annual meeting of the International Railway Fuel Association at Chicago, some interesting figures were presented relating to comparisons made on the Sant. Fé system where one-half of the locomotives have been constructed or converted to burn oil. The fact was brought out that the life of a boiler fired with coal is about 10 per cent greater than one fired with oil, while the life of the tubes is about 40 per cent higher in the coal burners.

Railway Fuel Conservation.—According to the *Railway Age*, the conclusions reached regarding fuel conservation are that this conservation depends upon efficient education of the whole of the railroad staff rather than confining it to the train crew, and the provision of a constant stimulus to maintain their intensity of interest in the subject by friendly competition and public spirit. Some other phases of the subject, such as economical speeds, facilities for adequate train housing and repair, selection of the best types of locomotives for specific roads, and train despatchers' duties are referred to, all of which are stated to be contributory factors in fuel conservation.

Chinese Railway Standardization.—Although it would probably be economically impracticable for one nationality to furnish and equip China with the extensive railway mileage necessary for the development of the country, it has been pointed out that the advisability of maintaining an adequate staff of American technical experts on the Chinese Railway Standardization Commission, as well as the expediency of offering facilities for the training of Chinese engineers in this country, are evident in the light of the opportunities for renewals and extensions of equipment by American manufacturers accruing from the establishment of American standards on the Chinese railways.

A New Oriental Line.—The steamer "M. S. Dollar" sailed from Vancouver on October 22 for the Orient, inaugurating on this voyage a new line of Oriental commerce. She has been fitted up with refrigeration machinery and has a capacity for 300 tons of frozen produce. This space will be used to ship Chinese fresh game, eggs, and meats to New York by direct steamer. If the venture proves successful other vessels of the Canadian Robert Dollar company will be fitted up with refrigeration holds. The ship will carry butter and other American dairy products westward. She operates on the triangular New York-Vancouver-Orient service.

Communication

South African Radio.—The Union Government has acquired the station at Windhuk, which was erected by the Germans and which originally was powerful enough to communicate with Berlin. This station will be put in order in the near future and will be one of the best equipped stations in the world. The

Windhuk station will be working with Oxford *via* Nairobi and Cairo, the scheme providing for stages of 2,000 miles each, transmission over which distance is assured. This will no doubt greatly relieve the ocean cables between South Africa and England, which are now unable to cope effectively with existing traffic.

Improvements in Arc Generators are described in a recent issue of *Wireless Age*, especially as concerns the Poulsen type. For purposes of coil insulation it has previously been considered essential to place the magnet windings in the lead from the generator to the arc electrode which is grounded, and with this arrangement it is inadvisable to ground the frame of the direct-current generator on account of the danger of burning out the generator insulation. L. F. Fuller, who has made many improvements on the Poulsen arc, finds that by combining the choke and magnet coils and placing them in the lead connected to the antenna side of the arc, and by grounding the generator side of the arc to the generator frame, a better and cheaper construction is possible, and the generator is safer to handle. Usually, but not necessarily, the negative lead is connected to the grounded side of the arc.

Fading of Radio Signals.—A detailed study of actual cases of "fading" or fluctuation in the strength of signals occurring in the area of the Persian Gulf and the Red Sea is given with the aid of maps and sections of intervening mountain ranges in a recent issue of the *Wireless World*. From the results of his observations the author expresses the opinion that these effects are entirely due to the differences in altitude of the intervening country, and he puts forward the theory that the intercepted wave does not pass to a considerable height (probably not more than one or two miles) above sea level, but that the maximum height attained increases with the distance, so that the less the range the nearer the semi-parabola of its course approaches to a circular arc.

A Worthwhile Tube Transmitter.—In a recent issue of *Telefunken-Zeitung* there appears a description of a ten-kilowatt transmitter employed at the Nauen station, using a battery of 30 tubes of 500-volt rating. The method of connection is described, and the method of operating. It is stated that this installation gave much trouble at first, but that the difficulties, mainly connected with the generation of oscillations of very high frequency, were gradually overcome. There is reason to expect that it will be possible to construct 10-kilowatt tubes and connect them in parallel so as to attain outputs of 500 to 1,000 kilowatts.

Electricity

Oil Switches for Heavy Currents are generally accompanied by difficulties in dealing with large outputs. The electrodynamic effects which arise with very heavy currents are the most serious source of danger. The very heavy current-rushes exercise both thermic and dynamic effects on the whole installation, and are most difficult to control by any preventive method, short of the predetermined artificial limitation of the short-circuit current. The value of this should not exceed 50,000 effective amperes. An authority states that if this limit is not exceeded, the process of opening a switch is more serious than that of closing it.

Safety Panels in Sections for residences, apartment houses, office and public buildings are now coming into general use. Metal sectional covers enclose the switches and bus bars, the switch buttons and plug fuses alone being exposed. This gives full protection to the operator against contact with live parts. Should it be necessary to replace a damaged switch, the sectional cover can be removed and repair made without disconnecting the wires, exposing other switches, or removing the panel from the box. The ensemble is a strong, compact panel of excellent workmanship and attractive appearance.

Foot-Operated Switch for Foiling Holdups.—The crime wave which has swept through many of our leading American cities of late has inspired John C. Rundback, a jeweler of New York City, to invent a novel form of foot-operated switch. This device consists of contact-making units arranged in the form of a long strip, and installed along the bottom of a counter or desk. In the event of a holdup, the victim can press any part of the contact-making member with his foot, thus closing a circuit and operating any given apparatus. The circuit may be used to ring a bell outside the store, turn in an alarm to the nearest police station, drop a steel curtain between the victim and the thieves, or for any other purpose. The contact-making member may even be arranged along the edge of the counter or along a wall, so that it may be depressed by leaning against it. At any rate, this novel switch arrangement may be operated while obeying the command of "hands up" and without arousing the suspicion of the bandits.

Locating Buried Conductors.—A long-buried conductor, for instance a cable or a pipe line, will tend to direct and concentrate electromagnetic waves traveling over the ground where the conductor lies buried, according to *Electrical World*. This is utilized for determining the location of such conductors in a method patented by a German radio company. A big coil antenna excited from an ordinary spark station on a motor car serves as a transmitter, and a similar coil antenna is used for receiving. The two antenna frames are carried along the ground, and the man receiving the message has to direct the carriers till a maximum sound is heard in his headphones. A wave length of 1,500 meters is employed, and using a 200-watt transmitter, the antenna frames must be kept 40 or 50 feet apart to avoid direct induction. Even a thin lead-covered single-pair telephone cable 5 feet or 6 feet deep could be located within a few feet by means of this outfit.

Mechanics

Getting Along Without Hand Filing.—A German company has introduced a milling tool which produces a finished surface equal to the best obtainable with hand filing. The cutting edges of this machine are similar to those of a file, but arranged spirally so that it is only necessary to press the work against the revolving cutter in order to get a true surface. The machine will cut through the mill scale of rolled sections and polish them bright in a remarkably short time. It will similarly cut through a crust of castings and give a bright smooth surface. It is conceded that a mechanic with a new file can cut one-fifth oz. of filings from a rough casting in a quarter of an hour, while the new machine will cut better than 17½ oz. in the same time from the same casting. What is more, the cutting member of the machine is said not to clog, and can therefore be used for a number of metals such as lead, copper, tin and zinc, as well as for such materials as hard rubber, slate, marble, celluloid, hard wood, bone and so on, where a file would be more or less useless.

A High Speed Hack Saw suitable for manufacturers having quantities of bar stock to be cut to repetition size, and offering a considerable saving in time and labor, has been brought out by a Chicago machine builder. At maximum speed and feed, the new machine will cut six-inch round cold-rolled steel in ten minutes, the resetting of the stock bar after each completed cut being automatic. Bars up to 20 feet in length may be handled and pieces up to 3 feet in length can be cut off.

How Precision Blocks are Made.—The general requirements of gage blocks, according to *Machinery*, are: (1) The two gaging surfaces should be true planes; (2) the gaging surfaces should be parallel to each other; (3) the length of the gage should conform to required dimensions and (4) the gage blocks of a set should differ in size by increments, making it possible to obtain any dimension within the range. A special chromium steel is recommended as a suitable material. The steel bars are sawn, straightened and ground, and after being drilled and countersunk are heat treated, again ground and finally sand-blasted.

Engineering

Canal Project for France.—Plans are being formulated for the construction of a canal to extend from the port of Dunkirk to the basin of Saarbrücken, permitting the navigation of boats up to 600 tons. The length of this canal will be approximately 600 kilometers (372 miles). The canal will be known as "Le Canal du Nord-Est."

Poland's Longest Pipe Line.—The longest pipe line in Poland for the transmission of oil was opened on September 6, 1920. This duct, which runs from Jaslo to Gorlitz, is constructed of 10-inch piping and is 28 kilometers (17.38 miles) in length. It is connected with another line that runs from Jaslo to Mezinek. Both these lines were constructed by the Polish Government and are used for the transmission of oil from the wells in Mezinek to numerous refineries and factories. Since the construction of the new pipe line a sufficient number of factories have begun to use oil as fuel instead of coal to result in the saving of 6,000 carloads of coal per year.

Why Rails Rupture — and a Cure. — From the *Comptes Rendus* we learn that a most frequent cause of the rupture of rails free from local manufacturing defects consists in the gradual development of fine fissures on the surface subjected to rolling action. Periodic examination and withdrawal of service rails showing signs of fissuring is the only preventive measure suggested up to the present time. The authors of the article show that the phenomenon is a very general one in materials subjected to intensive superficial work-hardening, and is particularly marked in hard metals such as chilled cast iron and hardened tool-steels. These French authorities suggest that superficial annealing prior to the critical age will rejuvenate rails and prevent the occurrence of fissuring. Such an operation could be carried out readily by means of the equipment mounted on wheels which has been devised for superficial hardening of the rolling surface. Such thermal cures, it is held, would do much to prevent fissuring and prolong the life of rails.

Concrete Pouring on a Vast Scale.—We are accustomed to big figures when speaking of modern concrete work. Yet a recent description of a large concrete plant, which appeared in a recent issue of *Engineering News-Record*, is startling enough to bear quoting here. The plant is to distribute 30,000 cubic yards of concrete from two 175-foot towers over an area of 800 feet by 1,800 feet. The elevator of each tower holds one cubic yard and does 30 trips an hour. The greatest length of main chute is 350 feet. Chutes are 12 inches wide and 8 inches deep at a uniform slope of one in three. A novel feature is that the chutes are practically rigid, being supported at 50-foot intervals by timber towers and braced laterally by truss wires over horizontal struts.

A Forty-Five Mile Aerial Cable Tramway being constructed in Colombia, South America, is reported to be half completed at this writing. It starts at Mariquita, at an elevation of 1,500 feet, crosses a 12,000-foot summit and descends to Manizales, which is at an elevation of 6,700 feet. The cableway is supported on 437 steel towers, of which 8 are over 130 feet high. The longest span is 3,168 feet. The track cable is a 2⅝-inch wire rope running on 24-inch sheaves. The carriers take normal loads of 670 pounds, traveling at 400 feet per minute. Steam driving plants will be employed as motive power, arranged in 30-horsepower units and distributed among 20 stations. Twenty-one miles of this cable tramway has been in operation since 1916.

Industrial Efficiency

American Import Figures.—The Bureau of Foreign and Domestic Commerce has just published part 1 of "Trade of the United States with the World, 1918-1919." This bulletin gives statistics covering the imports of merchandise into this country, by countries of origin and principal articles, during the calendar years mentioned in the title. For most of the articles included in the table, quantities (in addition to values) are given in the customary commercial units or in weight. This new publication, which is expected to prove peculiarly useful to American importers and merchants, is part 1 of Miscellaneous Series No. 106, and may be obtained for 10 cents from any of the district or coöperative offices of the bureau or from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Leather from Rabbit Skins.—According to American Consul Norton of Sydney, Australia, a secret process, said to be unknown hitherto to the tannery trade, has been discovered by an Australian for making leather from rabbit skins and recovering the fur as a by-product in felt making. A company has been formed in Sydney to turn this discovery to practical use, having established works capable of handling about 100,000 skins a week. The leather has already been utilized in Sydney in the manufacture of boot and shoe uppers, hand bags, gloves, and other articles.

Remitting Customs Duties to Develop Mines.—The Vancouver Board of Trade is endeavoring to assist development of the mineral resources of the province in a manner that should prove very satisfactory to United States manufacturers of mining machinery. The mining bureau of the board has recommended that the organization approach the Dominion Government asking that customs duties on mining machinery imported from the United States to the mines of British Columbia be remitted. Though British Columbia metal manufacturers are not wholly in sympathy with this proposition they have expressed themselves as willing to assist the board in the effort if it is modified to such an extent that it will not work an actual unfairness to them.

House externally protected from fire and weather by the liberal use of asbestos shingles

Asbestos shingles cover the roof and asbestos building lumber cloaks the sides of every building in this plant

Asbestos in Architecture

The Growing Importance Played by This Fibrous Substance in Modern Building

By Robert G. Skerrett

WHY asbestos is what it is the man of science cannot tell. He cloaks his ignorance by calling it a fibrous, hydrated silicate of magnesia, and then, looking wise, expects you to be satisfied. Despite the fact that Nature has kept her secret well, still day by day, comes a growing realization that "mineral flax" is serving increasingly useful purposes. Here in the United States the demand and the fields of application are widening at an impressive rate, and presently even the layman will ask, "How could we get along without the stuff?"

Back in the dim days of this planet's formative period, eons and eons before human kind conceived even elemental notions of economy and safety first, asbestos was stored in the veins of the earth's rocky crust to await the time when man's proper fear of fire and a keen desire for saving in a number of directions should make him cast about for a raw substance which might serve these ends either directly or indirectly. And now asbestos is robbing the flame of much of its menace, and the same material is conserving both heat and cold which primarily owe their intensity to the consumption of coal. Probably nothing is more suggestive of these efforts to arrest the fleeting dollars than the way in which asbestos products are figuring in modern architecture.

Here in the United States the annual fire loss totals more than $250,000,000, and the startling fact about this wastage is that most of it is a needless sacrifice. Because of this tribute to the flame insurance rates rise proportionately, and for our heedlessness we trace the "wicked circle" of added outlays. The wooden shingle is so often tinder to the chance spark; and the frame building and timber structures generally can offer but a feeble resistance to fire. Aside from this inherent fault, woodwork exposed to the weather is more or less perishable, especially if not painted or otherwise subjected to a preservative treatment.

But structural metal in the cases of roofing and various forms of sheathing is all too frequently no more enduring than wooden shingles, clapboard, and the like. Heat and cold, moisture, oxygen, and atmospheric impurities attack the iron, steel, copper and tin and bring about their oxidation and disintegration. Paint and other surfacings may suffice if applied at short intervals, but they involve repeated expenditures that represent a heavy offset against any apparent initial savings. Splendidly as wood and metal supply our wants in some directions it is dawning upon us gradually that we need more enduring and fireproof materials for certain parts of our industrial structures, our homes, our office buildings, our schools, etc. Happily for us asbestos is at hand to help out.

Inventive genius and manufacturing cunning have made possible shingles, roofing, siding and "lumber" composed of asbestos or of asbestos and hydraulic cement, according to the service required. The public is pretty familiar with asbestos covering for pipes, but it is only comparatively recently that we have profited by European example and accepted the asbestos shingle as something to be desired. It was only natural, with the ice thus broken, that our business enterprise would soon find other ways in which to work up asbestos and to employ these products to advantage. The pioneer in this evolution was Ludwig Hatschek, an Austrian asbestos worker, who, bent upon making thin sheets or slabs of cement for building purposes, conceived the idea of using asbestos fiber as a reinforcing material. Because of his invention, a single plant in Austria turns out yearly more than 100,000,000 square feet of asbestos-and-concrete roofing in forms susceptible of easy application. The secret of success depends upon the manner in which the asbestos and the cement are combined.

It seems that where the Hatschek process is not followed that the mixing of the material dry and then adding

(Continued on page 583)

Left: Corrugated paper from which "air-cell" coverings for pipes, etc., are made. *Right:* The final steps in the manufacture of asbestos paper or felt. *Above:* A stock-room display of corrugated roofing and siding of asbestos

Some of the forms in which asbestos contributes to the safety of modern building construction

The Flyer's Artificial Eye and Ear

By Dr. Alfred Gradenwitz

THE flyer's eye and ear are bound to fail him in a fog, in the clouds and by night—the eye, in so far as he no longer detects anything to guide him in the gray uniformity surrounding his machine, and the ear, inasmuch as his sense of direction and verticality, depending on the canals of the middle ear, no longer tells him at what angle his machine is banked.

In the last stage of the World War, all the huge fighters of the German army were fitted with a wonderfully efficient apparatus which could be fitly termed a substitute for the human eye and ear, viz., the Drexler Gyroscopic Steering Gage, which, of course, was developed on lines quite independent of the Sperry instrument. In designing this apparatus, the inventor availed himself of a less well-known gyroscope law. In fact, so far from starting from a "triple-liberty" gyroscope, that is, a top freely rotating in a Cardan suspension, he based his work on a "double-liberty" gyroscope, viz., a top free to rotate round its own axis, and, in addition, in another plane, though the latter rotation is limited by elastic strips or springs. In other words, a top in a Cardan suspension, of which the outer ring is fixed while the deflection of the ring carrying the gyroscope is limited in the manner just outlined.

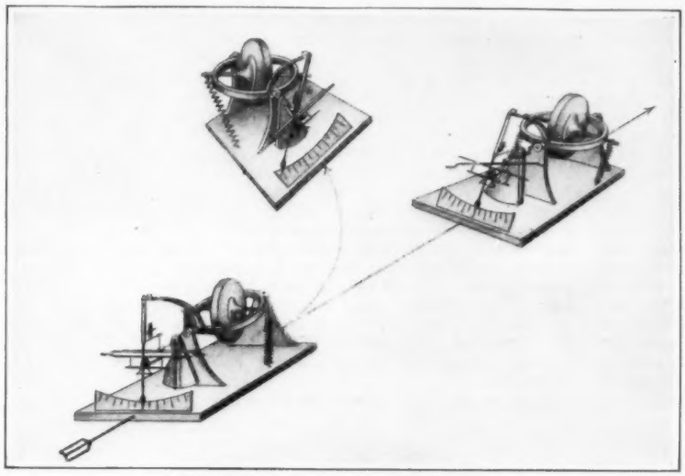
If such a gyroscope be inclined sideways it will not show any deflection, but, on account of the tension of the elastic bands or springs, and the stationary arrangement of the ring carrying the top at right angles thereto, it will readily follow any inclination of the gyroscope.

If, however, the apparatus be turned round in the direction of the arrow, the *law of precession* will come into play; that is to say, the top will respond to any thrust in the direction of the arrow by a rotation at right angles thereto. So far from following the rotation corresponding to its previous position, the top will therefore deflect, overcoming the tension of the elastic bands as indicated pictorially.

A "double-liberty" gyroscope such as this, provided with an index, is so installed on the flying machine that the top, as long as no outside forces are exerted upon it, will rotate in a plane determined by the vertical line and the direction of flight. This top, apart from its rotation round its axis, can only perform a motion limited by springs at right angles to the longitudinal axis of the flying machine. Where the top occupies the position just outlined, the index connected with it will be in its central position, thus showing that the machine is flying straight ahead. If, however, the machine voluntarily or involuntarily describes a curve, the outside frame carrying the top, which is rigidly fitted into the flying machine, will be turned, thus causing the top and the index connected with it to deflect at right angles thereto, to the right or left, according as the curve described is a right-hand or a left-hand curve. As soon as the machine is again flying in a straight line, the springs above referred to will reduce the curve index to its central position.

The gyroscope is combined with a transversal pendulum oscillating in a damping glycerine casing, for indicating any transversal deflection from the horizontal position of the carrying planes, while a specially designed liquid level gage allows even the slightest longitudinal inclination of the plane to be noted. The reading marks of the pendulum should always agree with the upper carrying surfaces of the flying machine phantom, if the machine, in flying either in a straight line or in a curve, is to be in equilibrium. A special readjusting attachment enables the apparatus to be adapted to the peculiarities of the machine or any personal preference of the pilot by allowing the angle of inclination in curves to be increased or reduced at the free will of the aviator.

The use of this steering gage not only means increased safety to the pilot and passengers, but relieves the enormous strain upon the nerves of the pilot, who no longer has to spy about and anxiously to look for his bearings at the ground below him through the fog, clouds and darkness.



The German double-liberty gyroscope, showing the manner in which deflection of the plane carrying it from the true horizontal affects the instrument

Finding a Cool Hat

HOWEVER lightly one may be clad there is little comfort in the hot weather if the hat is not having a cooling effect. In this connection some interesting tests have been made to determine the heating or cooling action of various kinds of hats commonly worn. On a very bright day when the shade temperature was 96.8°F. seven individuals were given hats, each one being of a different type. These were worn outdoors for two hours and at the end of this time the temperature inside the hats was taken.

In the case of a typical soldier's hat, made of cloth and with a hard peak, the reading was very high, being no less than 98.6°F. In an ordinary cloth cap it was 94.1°. Inside the hard round bowler the record was 92.3°. Contrary to expectation the silk hat came fourth on the list with a temperature of 89.6°. The hard straw hat was not very much cooler with a temperature of 86.0°. Very much more comfortable was the soft felt hat with a reading of only 79.7°. It was discovered that, where the felt was black, or very dark in color, the air inside was much hotter than in the case of a light shade. The figures given are for a hat of a somewhat pale gray hue. Coolest of all hats is the soft straw Panama, which gave a temperature of 77.9°.

How the new system facilitates the installation of wall fixtures; and the outlet plate, ceiling plug and wall plug

When a Lighting Fixture is Not a Fixture

By George Gaulois

ELECTRIC lighting fixtures need be "fixtures" no longer. Why? Because a device recently invented and now developed on a practical scale makes it possible to move electric chandeliers and wall brackets from place to place as easily as electric toasters, vacuum cleaners and other appliances are plugged in the usual lighting circuit.

The basis of the new invention, which promises to mean much in the electrical industry, is a plug with curved blades. This plug may be attached to any wall light. With its lighting fixture attached, this plug is inserted with a rotary motion into a new type of electric outlet, the blades pointing upward. Electrical and mechanical connections are made at the same time; and the plug, supported by the curved blades, is strong enough to hold the heaviest wall fixture. The outlet looks very much like the familiar baseboard plate, having two parallel slots in a rounded triangular center.

An inconspicuous circular plate marks the new ceiling outlet, which forms a unit of this novel system of fixtures. A plug with curved prongs also is provided for this outlet. It differs from the wall plug, however, in that one-half of the plug is inserted at a time, the prongs extending in opposite directions. A hook at the other end of the plug supports the chandeliers, and makes the necessary electrical connections by means of flexible wires. Now these mechanical hooks, as distinguished from the curved prongs which make the electrical connections and also secure the lower hooks to the ceiling, may be arranged either in a coinciding or in an opposite manner, so as to form in construction either a hook or a ring. In either event the ring of the chain supporting the fixture serves to hold the two halves together, thus locking the entire arrangement in place.

The devices for this new system are to be manufactured by a number of companies and will be on the market by the beginning of the new year. The flexibility of lighting which will be afforded by this system will be especially appreciated in the home. The ability to rearrange and replace lighting equipment without the services of the electrician will make possible a rapid development in the science of home lighting. Builders of new homes will be freed from the necessity of selecting all their lighting fixtures before the house is finished. A sufficient number of outlets provided for in the architects' plans will make it possible to buy lighting fixtures as needed after the house is finished.

What Is Dry Rot?

THE term "dry rot," the Forest Products Laboratory finds, is applied by many persons to any decay which is found in wood in a comparatively dry situation. Thus loosely used the term actually includes all decay in wood, since wood kept sufficiently wet cannot decay.

In the more limited sense in which pathologists use the term, "dry rot" applies only to the work of a certain house fungus called *Merulius lachrymans*. This fungus gains its distinction from the fact that it is frequently found growing in timbers without any apparent moisture supply; in reality it does not grow without moisture and is as powerless as any other fungus to infect thoroughly dry wood. Given moist wood in which to germinate, it is able to make its way a surprisingly long distance in dry timbers, drawing the water it needs from the moist wood through a conduit system of slender, minutely-porous strands. Wood in the typical advanced stage of dry rot is shrunken, yellow to brown in color, and filled with radial and longitudinal shrinkage cracks, roughly forming cubes. In many instances these cracks are filled with a white felty mass, the interwoven strands of the fungus.

The dry rot fungus is active in nearly every region of this country, in Canada, and in Europe. It is destructive to timbers and logs in storage. Soft woods are more commonly infected by it than hard woods.

The Heavens in December, 1920

Star Clusters—Their Bona Fides and Their Distances from Us

By Professor Henry Norris Russell, Ph.D.

IN various parts of the sky the stars appear to be grouped into more or less conspicuous clusters. Most of these are visible only with the telescope, but here and there we find one in which the individual stars are so bright, and so widely scattered in the sky, that the character of the group can be recognized by the naked eye. The astronomers of ancient times—who were active and careful observers, so far as the means at their disposal permitted—recognized several of these clusters, and gave them names, which have come down to us, and are still in use. The most conspicuous and the most famous cluster of all is doubtless the Pleiades, which, from the brightness of the stars and their close association, attracts the attention of the most casual observer. Not far away, and also in the constellation Taurus, is the more scattered group called the Hyades—the "rainy stars," because their appearance marked the beginning of the rainy and stormy season in Greek waters. Farther east in the heavens, in Cancer, is a hazy spot, known to the ancients as Praesepe, meaning a sheepfold or a manger. The unaided eye just fails in this case to recognize the individual stars, but a small opera glass shows them distinctly. Eastward again, beyond Leo and to the north, is a scattered group of stars, just comfortably visible to the naked eye, which has been elevated to the dignity of a constellation, Coma Berenicis, or Berenice's Hair.

Are They As They Seem?

When the modern astronomer comes to consider these clusters, the first question he asks is, naturally, "Are the stars of these groups really near together in space and associated in some way, or do we have to deal with a mere accidental grouping of unrelated stars, some near by, some remote, and looking close together in the sky only because they happen to be almost in line with one another?" For a compact group like the Pleiades, common sense suggests, and calculation confirms, that it is incredible that so many conspicuous stars should by mere chance be crowded into so small a region, with the whole expanse of the heavens available. But for a more scattered assemblage like the Hyades, this simple test is insufficient.

The tale has long ago been told in our columns how Professor Boss, having completed his great catalog of the proper motions of the brighter stars, found that forty stars, in the Hyades and the surrounding region, were moving across the heavens in about the same direction and at almost the same rate. This noteworthy discovery put it beyond question that the Hyades, too, were a real cluster of stars which now are fairly close neighbors in space, and have been so in the past for an indefinite time. What is more, it appeared, on careful study, that the motions of these stars in the sky were not quite in parallel lines, but that they converged toward a definite point, about ten degrees east of the bright star Alpha Orionis; so that if we could watch the cluster for ages, we should see it approach this point in the heavens, and apparently shrink together as it did so. This must obviously be an effect of perspective, arising from a gradual recession of the cluster from the sun. Observations with the spectroscope showed that these stars were actually receding, and all at the same rate—another proof of physical connection. By combining what we know of the apparent rate of motion of the cluster in the sky, and the real rate in kilometers per second, Boss succeeded in calculating its distance, which came out 140 light-years.

Not all of the naked-eye stars in this part of Taurus really belong to the cluster—for example, Aldebaran, the brightest of all, is moving across the sky in quite another direction, and is probably considerably nearer to us than the cluster stars. But these outsiders can be recognized at once by the fact that their motions do not agree with that of the cluster.

A similar community of motion exists among the Pleiades, and is found also in Praesepe, and among many, though not all, the stars in Coma Berenices. It appears therefore that all these groups are real clusters. But there is no other case in which the perspective effect of convergence of the motions has so far been detected—mainly because the other clusters cover such small regions of the sky; hence we cannot apply Boss's ingenious method to determine the distance of any of the other clusters. Success has, however, recently been obtained in the case of Praesepe. Before the war, Schwarzschild, one of the ablest of German astronomers, found spectroscopically that the brighter stars in this cluster are all receding from the sun at the same rate, and noted that this rate is almost the same as in the case of the Hyades, while the proper motion of the group, though small, is directed nearly toward the point in the heavens toward which that group is moving. This suggested that the two clusters, though sixty degrees apart in the sky, were really moving in parallel lines in space, and that, in the course of millions of years, the inhabitants of the earth might see them drawing closer and closer to one another in the sky, shrinking in size and growing fainter as they went.

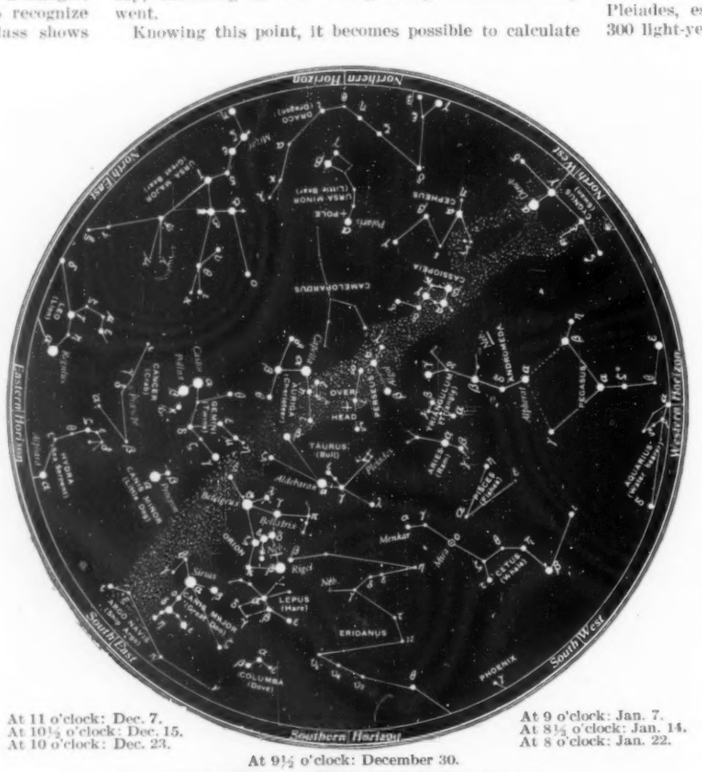
Knowing this point, it becomes possible to calculate the present distance of the Praesepe group. With the best data available, this comes out 560 light-years—four times the distance of the Hyades. A striking confirmation of this calculation has recently been furnished by another German, Kohlschütter. It has long been known that there is a remarkable relation between the brightness of the stars in the Hyades and their colors and spectral types. Stars in this cluster which are of the same real brightness as the sun are very similar to the sun in spectrum. Those fainter than the sun are redder, and more "advanced" in spectral type, while most of the brightest stars in the cluster are white, almost like Sirius in spectrum, and average almost forty times as bright as the sun. There are, however, four bright stars, clearly belonging to the Hyades, which are redder in color, and have spectra like Arcturus. These red "giants," which average some fifty times brighter than the sun, have their counterparts all over the sky, and have played a very important part in the theory of stellar evolution.

Further Data on Distances

Kohlschütter has confirmed these facts regarding the Hyades, and made a similar study of the stars in Praesepe. In this case only the brighter stars of the cluster can be observed (the rest are too faint); but among these just the same situation is found. Most of the true members of the cluster are white, while a few, equal in average brightness to the others, are strongly reddish.

In each case the average apparent brightness of the stars is just about one-tenth of the apparent brightness of the corresponding stars in the Hyades. If we assume, as seems very probable, that the actual brightness of the stars of similar character is the same in the two clusters, we are led to a distance for Praesepe of 450 light-years—agreeing with the other as well as it is reasonable to expect, on account of the uncertainty of some of the data. The average of the two determinations, 500 light-years, is probably a very good approximation to the actual distance of Praesepe.

It may be added that the brighter stars in Coma Berenices show a similar distribution in color and spectrum, which indicates that the distance of the cluster is 300 or 400 light-years. The distance of the Pleiades, estimated in other ways, is probably about 300 light-years.



At 11 o'clock: Dec. 7.
At 10½ o'clock: Dec. 15.
At 10 o'clock: Dec. 23.

At 9 o'clock: Jan. 7.
At 8½ o'clock: Jan. 14.
At 8 o'clock: Jan. 22.

At 9½ o'clock: December 30.

NIGHT SKY: DECEMBER AND JANUARY

The Heavens

Our map shows that three of the four clusters of which we spoke are now well observable. The Pleiades and Hyades are close to the meridian and very high in the sky. Practically all the stars near Aldebaran except Aldebaran itself belong to the latter group. Praesepe is well up in the east, below Castor and Pollux. The stars Gamma and Delta Cancri, which are close to it on each side, were called by the ancients the "Aselli," the donkeys which are browsing at the manger. Coma Berenices has not yet risen.

The southeastern sky is very fine, with Orion, Canis Major, Canis Minor and Gemini. With the splendid stars Sirius, Rigel, Betelguese, Procyon, Castor and Pollux in their number, and Aldebaran, Capella and Regulus among their close neighbors, it is with ample justification that these are often referred to as the "brilliant winter constellations." Leo and Hydra are rising, in the east, and Ursa Major is coming up in the northeast. Draco and Ursa Minor are low in the north, while Cassiopeia and Cepheus are well up in the northwest. Auriga and Perseus are overhead, and Andromeda and Pegasus conspicuous in the west. Cetus and Eridanus occupy the dull southwestern sky.

The Planets

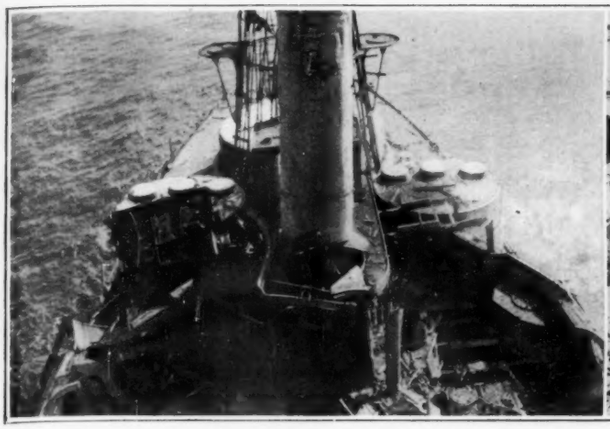
Mercury is a morning star, and is best seen about the time of his greatest elongation on the 3rd, when he rises about 5:30 A. M. Venus is an evening star, and sets about 7:30 P. M. in the middle of the month. Mars too is an evening star, and sets more than an hour after Venus when the month begins. Venus is moving eastward faster than he is, and by the end of the month the two planets are only about four degrees apart.

Jupiter is in quadrature, west of the sun, on the 10th, and crosses the meridian at 6 A. M. He is therefore visible all through the latter half of the night.

Saturn is about six degrees east of Jupiter, and also visible after midnight. Uranus is in Aquarius, and sets at about 10 P. M. in the middle of the month. Neptune is in Cancer, and is observable in the morning hours.

The moon is in her last quarter at 11 A. M. on the 2nd, new at 5 A. M. on the 10th, in her first quarter at 10 A. M. on the 18th, full at 8 A. M. on the 25th, and in her last quarter again during the last hour of the year. She is nearest us on the 25th, and farthest away on the 13th. During the month she passes near Jupiter and Saturn on the 3rd, Mercury of the 8th, Venus on the 14th, Mars on the 15th, Uranus on the 16th, Neptune on the 28th, and Jupiter and Saturn once again on the 30th.

At 10 P. M. on the 21st the sun reaches its greatest southern declination, and enters the "sign of Capricorn," when, in almanac language, "winter begins."



Destruction of main and super-structure decks, looking toward bow

Effect of a single bomb on main deck. Note that bombs were placed and not dropped

Bombing the Old Battleship "Indiana"

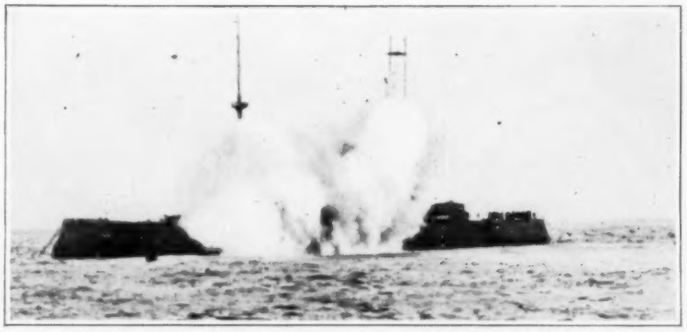
WITH a view to determining the effect which bombs of various sizes would have if dropped upon a battleship, that ancient craft, U.S.S. "Indiana" was selected as the subject of experiment. The "Indiana" class of three ships was laid down in 1891 and completed in 1895. The designs, therefore, of these ships are fully thirty years old, and consequently the "Indiana" has for many years been quite out of date, although she had a refit in 1905.

The vessel is 348 feet long, 69 feet, 4 inches broad, and displaces about 10,300 tons. She has a belt 15 to 18 inches in thickness, carries 17 inches of armor on the barbettes, and 8½ inches on the turrets. Her armament consists of four old 13-inch guns and eight 35-caliber 8-inch guns—at least that was the original armament. She is protected, in addition to the 18-inch belt, by a 3-inch protective deck at the water line and a 5-inch side protection from the water line belt up to the main deck. It should be understood that all of this armor is of the old Harvey type.

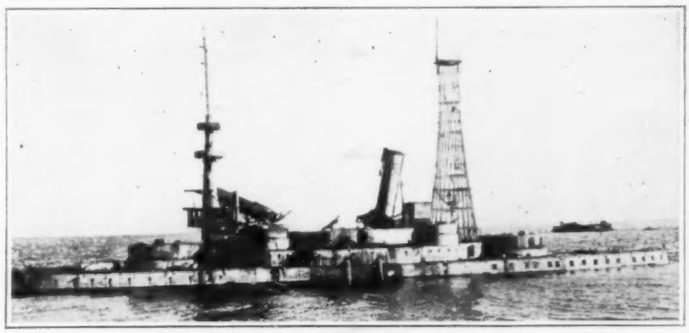
The "Indiana" is to be used by our modern fleet as a target, suffering the same fate as the old "Texas," renamed "San Marcos," the wreck of which can be seen in the offing beyond the quarter deck of the "Indiana" in one of our pictures.

Before subjecting her to gun fire, it was decided to anchor the "Indiana" in shoal water in Tangier Bay in the Chesapeake and cause her to settle upon the bottom by bombing the ship. It should be understood that the bombs were not dropped from airplanes, but were placed in positions, where their detonation would provide the information which the naval authorities were seeking as to bomb destructiveness on certain selected parts of the ship. The bombs were placed both within the ship and outside of it, some of the exterior bombs being in contact with the side of the ship below water and others being detonated at varying distances from the side. The results of this attack can be gathered from a study of the illustrations on this page.

These experiments were intended, not as a trial of bombing from the air, but merely to determine the effect of bombs of varying weight and power, if they struck at certain selected positions, or at varying distances from the ship. The art of bombarding from the air is yet quite in its infancy. To make a hit the plane must descend so low as to be fairly certain of being shot down. If it attacks out of anti-aircraft gun fire range, hitting the target becomes a matter of sheer good luck.



Detonation of bombs below water and near side of "Indiana"



The battleship "Indiana" on the mud where she will serve as a target. The wreck of the target "San Marcos" is seen beyond quarter deck of "Indiana"

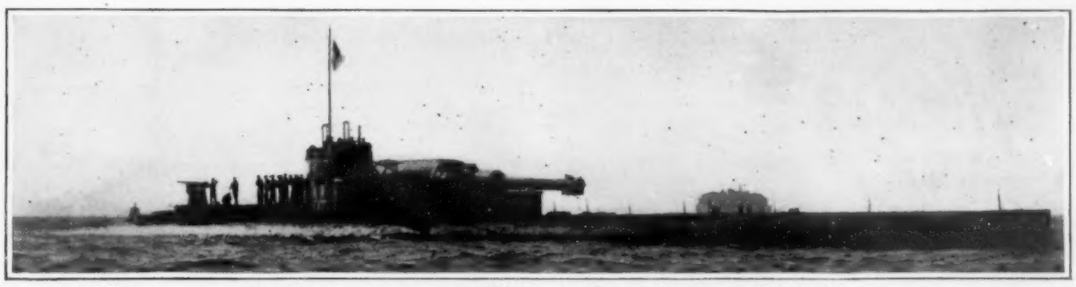
The effect of bombs on structure of "Indiana"

Battleship Guns on Submarines

IF anyone six years ago had stated that within a few years' time submarines would be going to sea carrying 12-inch guns, he would surely have been regarded as a visionary. The British Navy showed an astonishing freedom from conservative restraint in its handling of the naval problems which the war developed, and in two directions, that of the battleship and the submarine, we witnessed two remarkable developments, first, in the "Hood," a ship 860 feet in length, combining heavy battleship armor and armament with a speed of 32 knots, and here, in the "M-1," as it is called, in which we have a submarine carrying a gun that not so very many years ago was used only as the principal weapon on board of the most powerful battleships.

Just how far this latter development will go, it is difficult to predict. Lord Fisher, if we remember rightly, believes that the near future will see fleets of submersible battleships—big seaworthy vessels carrying full armaments of heavy guns and capable of entire submergence. It cannot be denied that "M-1" seems to point that way; but until she has been tried out under varying conditions and put to thorough tests of her habitability, seaworthiness, endurance, rapidity of submersion and all-round maneuvering ability, it would be rash to make any confident predictions as to the future of this type.

Although the British have been surprisingly frank in disclosing the particulars of the ships which they built during the war, it is significant that they have said very little about "M-1" and her sisters. In fact, the only definite statement that we have seen was one to the effect that these boats were built specially for service in the Dardanelles, where they were to be sent in for close bombardment of the forts.



The "M-1," a new type of British submarine, mounting a 12-inch gun

State Friction and Lubricating Properties

IN an attempt to throw further light on an observation made by Rayleigh that, in certain cases, the friction is greater with a large amount than with a minute quantity of the same oil, experiments have been made on the static friction between perfectly clean glass surfaces and on the effect of a number of pure liquids when used as lubricants.

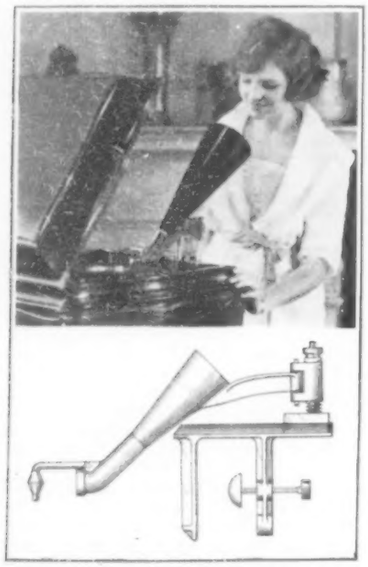
The clean surfaces were found to "seize," and when a sufficiently strong tangential force was applied to cause movement, the first effect was to tear the two glass surfaces. The liquids examined fall into two classes. The first class, the inactive fluids which have no lubricating effect, includes water, ethyl alcohol, ethyl ether, benzone, strong ammonia, and glycerine, but the last substance can exert the maximum lubricating effect if the surfaces are flooded.

Among active fluids were found sulfuric, hydrochloric, acetic, butyric, and oleic acids, a number of organic bases, castor oil, and paraffin. It was noticed in the case of some of the acids that the friction was slightly greater with the surfaces flooded than with an invisible film of liquid.

The evidence is against the conclusion that lubrication is a function of the quantity of lubricant when this is a pure chemical substance and when the viscosity is not very great, we are told.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



How the home recorder is used and its mechanical details (diaphragm and cutting tool not shown)

Home-made Records for the Disk-Type Phonograph

WITH the more or less complete disappearance of the cylinder-type phonograph, there passed away the former possibility of making one's own records—a feature that made for no end of added pleasure for the phonograph owner. The mechanical details of the usual disk phonograph are such as to preclude the making of phonograph records at home except through the use of some elaborate accessory.

It has remained for C. E. Sanders of New York City to develop a practical form of recording device which can be attached to any standard disk phonograph for producing home-made records. Aside from making records of various members of the family, the recorder can be employed for divers other purposes, such as in the school room, laboratory, singing school, and so on. At any rate, this device can be readily attached to any disk phonograph and used by anyone, because of its simplicity.

The starting point in our description of the home recorder is a special soft-wax disk, which is placed on the turntable in the same manner as the usual record. A metal disk, with a fine spiral groove, is placed over the center of the wax disk or blank. The reproducer is made in the form of a resonator and operates a fine cutting tool resting on the soft-wax blank. As the wax blank is turning, the recorder is slowly fed along through the small guide that rests in the spiral groove of the metal disk. Thus a good hill-and-dale cut record is produced, and by using the usual phonograph soundbox the music can be reproduced. Obviously, such a record, being made in soft wax, is not intended for long wear. If one desires to make it permanent, the manufacturers of the new device are prepared to duplicate it in the shellac compounds that we are accustomed to buying as regular records.

By means of a special fluid it is possible to efface the grooves and create a smooth surface for the next recording. Thus one blank can be used over one hundred times.

In the accompanying illustration will be noted the device attached to a standard disk phonograph, as well as a line drawing of the device itself. In this case the cutting tool and diaphragm are not shown; these members fit at the lower or smaller end of the horn.

A crank-operated shearing machine which expedites this kind of work

An Interesting Plier Wrench

A WISCONSIN manufacturer has brought out a type of wrench which may be instantly adjusted to fit any size of pipe or nut within its capacity. The arrangement of the two sliding bearings and fulcrum give compound leverage and an exceedingly powerful grip may be obtained. The jaws of this wrench are always parallel. It is particularly adapted to tightening or removing nuts.

Any nut can be firmly held in the jaws of this pair of pliers

Turning the Crank to Shear the Sheep

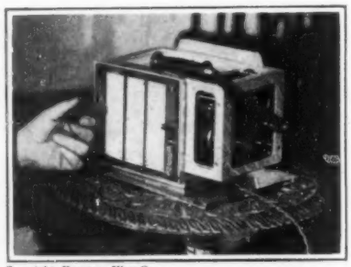
AN ingenious American has developed a hand-power shearing machine which makes short work of this particular task. As will be noted in the accompanying illustration, this device consists of a crank, reducing gears, transmission shafts with universal joints, and the shearing mechanism proper. Turning the crank causes the cutting blades to function. Two men are required with the crank-operated device, one for turning the crank and the other for the shearing.

Truck With Electro-Magnetic Crane

A MOTOR truck company of Bay City, Michigan, has the distinction of manufacturing the first motor truck equipped with an electro-magnetic lifting crane. The machine has a 4-ton capacity and is a special order. It was tested recently and found to measure up to requirements. It is said that it will do the work of 20 laborers. A special crane was manufactured for this truck in which all operations are performed by power. It is equipped with quick-acting out-riggers in order to insure stability. The motor truck and crane can be used for loading or unloading cars of iron, etc., for handling scrap iron in yards, for loading other motor trucks or drays or for loading the motor truck itself, and can be used as a crane in handling any heavy object. This motor truck was manufactured as a special order for a Detroit concern, and will be sold at a consideration of $12,000.

A Device That Takes the Place of the Radio Operator

RADIO equipment is absolutely necessary if an airman desires the maximum safety in flying. However, with the radio telephone handicapped by a very limited range, and the radio telegraph necessitating a knowledge of the telegraph code, the installation of a radio equipment aboard an airplane has heretofore presented numerous difficulties.



Copyright, Keystone View Co.

An automatic wireless transmitter which enables airmen to send messages

Now comes F. S. S. Wates of London, England, with an automatic radio transmitter which enables anyone to send certain wireless messages by merely manipulating a plug. The device, which is shown in the accompanying illustration, consists of clockwork driving a series of contact-making wheels, and a plug for making connections with any desired wheel. Each wheel has teeth which represent the dots and dashes of a given standard message, and the aviator plugs into the hole corresponding with the message he desires to transmit, and pulls the lever which operates the clockwork.

The automatic transmitter carries a large number of standard messages, a "forced landing" call, and the names of the leading towns along a given route. Thus if the airman is compelled to descend, he depresses a small lever and inserts the plug into the town nearest the forced landing. Obviously, this device, which weighs but ten pounds, is not a radio transmitter in itself; it must be employed in conjunction with a standard wireless set.

Taking the Hard Work Out of Sawing

EVEN with the sharpest saw the task of sawing a hardwood board is anything but a sinecure. While our modern sawmills are models of efficiency and labor saving, the carpenter still does his work by tedious hand methods.

So it has remained for Charles M. Geiger of Chicago, Ill., to invent an electrically-operated hand-saw. His labor-saving device consists of a small electric motor which drives a small but extremely sharp saw through suitable means. The saw reciprocates at a high rate of speed, so that there is very little resistance offered to its motion by the wood being cut. In this manner, so we are told, the electric saw can be held in position with the right hand, while the left hand guides the reciprocating blade along.

The electric hand saw which speeds up sawing operations

Something New in Tire Rims

DESPITE the many ways of putting an automobile tire on its rim, this field still appeals to inventors because the present ways are by no means the last word in convenience and dispatch. One of the latest ideas for tire rims is that shown in the accompanying illustration. Here is an automobile tire rim that can be taken off one shoe and transferred to another shoe in thirty seconds, according to its inventor. It is made in two parts, with two other pieces of the rim hinged together. The rim, when placed on the shoe, is locked with a small lever that works on a swivel at the bottom of the rim. The tire is placed on the rim and the two small sections of the rim are forced together as shown. The little clamp then holds the two sections in place.

A tire rim that can be transferred from one shoe to another in thirty seconds

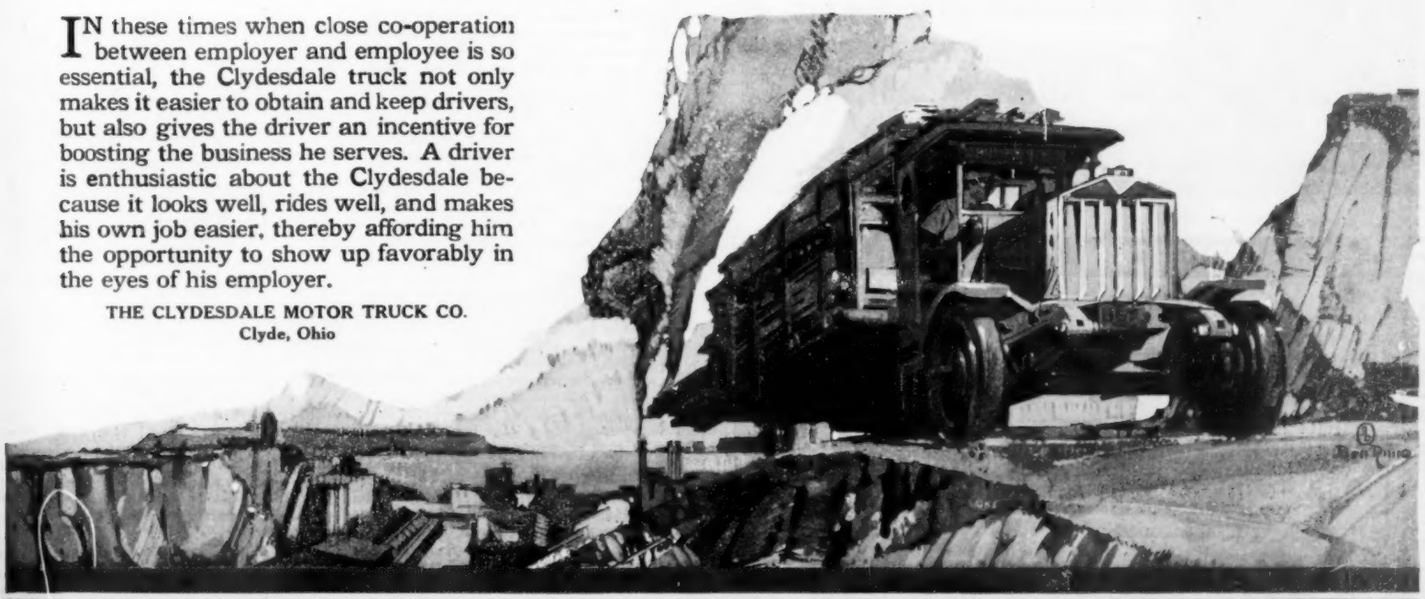
PERFORMANCE

WHY DRIVERS SWEAR BY THIS TRUCK, NOT AT IT

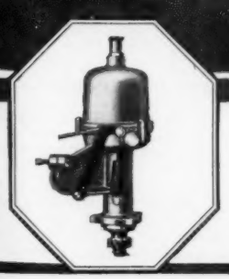
WHILE the purchase of the first truck may not be influenced by the driver's opinion, the performance of that truck in the hands of the driver often determines the selection of a second one. Clydesdale preference among drivers is founded upon two facts—mechanical excellence which includes power, adequate speed and ease of adjustment, together with the Clydesdale Controller which enables the driver to forget everything but the road.

IN these times when close co-operation between employer and employee is so essential, the Clydesdale truck not only makes it easier to obtain and keep drivers, but also gives the driver an incentive for boosting the business he serves. A driver is enthusiastic about the Clydesdale because it looks well, rides well, and makes his own job easier, thereby affording him the opportunity to show up favorably in the eyes of his employer.

THE CLYDESDALE MOTOR TRUCK CO.
Clyde, Ohio



CLYDESDALE MOTOR TRUCKS



"The Driver Under the Hood." Just as the locomotive engineer looks to his fireman to see that enough steam is maintained to pull the load, the driver of a Clydesdale truck depends upon the Clydesdale Controller to keep the motor going at whatever speed is necessary to pull the load.

Whether up or down hill, through mud or sand, over rough or smooth roadbed, the Clydesdale will travel at a uniform speed once the throttle is set. On an upgrade, the controller feeds the motor more gas. On a down-grade, it cuts down the gas. All the driver needs to do is steer and shift gears when necessary.

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farming Implements, Etc.

Of General Interest

CAN COVER.—J. M. HATFIELD, 1111 N. Penn. Ave., Independence, Kan. This invention has for its object to provide a device especially adapted for enclosing cans of nitroglycerine and other explosives, wherein a relatively soft, flexible cushioning casing is provided for containing the can and for covering every part thereof to prevent the possibility of frictional contact of the can with other objects.

WINDOW CLEANER.—M. GOLDSTONE, 496 Chauncey St., Brooklyn, N. Y. The primary object of the invention is to provide a mechanically-driven window cleaner, which may be used to clean windows or other surfaces at a rapid rate without employing a ladder or for cleaning large show and store windows where considerable surface is exposed and considerable manual labor necessary.

REVOLVING HOUSE.—S. M. STEVENS, 1 Ravenscroft Rd., Asheville, N. C. This invention particularly relates to dwellings adapted for sick persons, or what are known as outdoor sleeping rooms; the object is to provide a dwelling having an open side which may be revolved in order to face in any desired direction. A further object is to provide electrically-operated driving means for revolving the house, the house being fitted with a number of conveniences.

WINDOW VENTILATOR.—F. SCELTZ, P. O. Box 380, Harrison, N. Y. The invention relates to a window ventilator which will permit a free movement on the part of the frame, a filtering element being incorporated with the structure insuring against the entry of impure air, the filter being readily cleanable at all times; the ventilator will also permit of an adjustment of the flow of air.

FILM HOLDER.—C. L. BAMBRIC, Brooks, Alberta, Canada. The object of the invention is to provide a film holder which will maintain a film in a stretched out condition without danger of creasing while allowing an easy washing thereof or dipping into the developing solution. Another object is to provide a holder which is readily adjusted for different widths of films.

MARKING DEVICE.—C. M. GRAVATT, Cold Springs, Okla. Among the objects of the invention is to provide a device which is especially adapted for marking cloth or clothing of any character so as to identify the material or article; it is especially adapted for use in connection with laundry work to distinguish the property of different customers.

TRUNK BAND.—R. T. EMERY, 121 Fellsway, W. Medford, Mass. The invention relates to trunk bands or straps preferably of bendable material which can be positioned around a trunk and securely locked in place, and when in such position will operate to strengthen the trunk and prevent injury as well as prevent opening of the trunk by unauthorized persons. A further object is to provide a device which will not disfigure the trunk.

PERPETUAL CALENDAR.—J. L. HUTSON, Shelbyville, Tenn. The object of the invention is to provide a perpetual calendar adapted to indicate any desired date of either the Julian or Gregorian system. Another object is to permit the user to rapidly set the calendar for any date of past, present or future years. Another object is to permit the user to set the calendar for the present month and to allow of making the desired changes at the end of a month or year for the next ensuing month of a year.

ROADWAY.—A. ANFINSON, Wakonda, So. Dak. The object of the invention is to provide mechanism for use in connection with ordinary country highways, for converting said highways at small expense and in a minimum of time into metaled road ways; to provide relatively narrow tracks of plastic material capable of hardening, such for instance as concrete.

EGG MIXER.—R. G. WILSON, Davis, W. Va. This invention relates generally to mixers, and more particularly to a portable hand mixer for domestic use in mixing fluids and semi-fluids, the object being the provision of a simple, inexpensive apparatus which may be readily cleansed after using and thus maintained in highly sanitary condition.

Hardware and Tools

DOUBLE CLAMP.—G. T. BENTON, Willow Springs, Mo. The invention relates more particularly to a clamp which may be utilized for various purposes in connection with the fitting and setting of doors, windows and the like, the object being the provision of a simple, effective double clamp of the jointed nature which facilitate certain specific operations in addition to its general application.

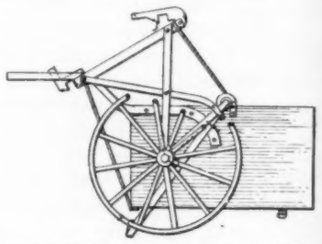
Machines and Mechanical Devices

PULLEY.—A. SGRITTA, address A. Sgritta & Co., 94 Spencer St., Brooklyn, N. Y. The invention relates to belt-carrying pulleys for the transmission of power, and resides specifically in providing the rim of the pulley with a nurling to prevent the slipping of the belt and the lateral displacement and disengagement thereof, thus effecting a saving in power and economy of fuel, itme and labor..

PUMP.—H. M. HALL, Box 464, Wilcox, Arizona. The invention has for its object to provide a pump wherein the parts are so arranged that the barrel and plunger of the pump, together with the valves, may be easily and quickly detached from the suction pipe, or connected therewith without the necessity of pulling the said pipe from the top of the ground.

Pertaining to Vehicles

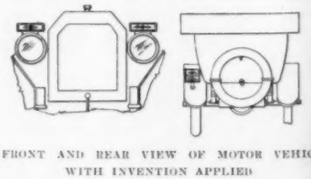
SELF-LOADING COAL AND GRAIN TRUCK.—J. A. KLOVSTAD, Hope, N. D. The invention has reference more particularly to that type of hand trucks that are designed to be self-loading and useful on farms, in cars, and warehouses, its main object being to provide a hand truck that will quickly load itself, and can be transported from place to place with and without its load.



A SIDE ELEVATION OF THE TRUCK IN POSITION FOR BEGINNING TO LOAD

RESILIENT WHEEL.—M. B. DISKIN, 76 W. 3rd St., New York, N. Y. The invention relates particularly to wheels having rigid rims and flexible spokes. Among the objects is to provide a wheel for vehicles which shall possess the desired resiliency for the comfort of the occupants of the vehicle and for practical purposes and yet shall not be subjected to the inconveniences incident to the use of pneumatic tires.

DIRECTION INDICATOR.—R. P. SAFELY, 410 42nd St., Oakland, Cal. The primary object of the invention is to provide an electric direction indicator for motor vehicles which can be conveniently manipulated by the driver or person sitting next to him to indicate to an approaching vehicle the direction that the vehicle is to take, for instance, when making a righ or left hand turn around corners. A further object is to so construct the device that it may be installed on a vehicle as an accessory.



A FRONT AND REAR VIEW OF MOTOR VEHICLE WITH INVENTION APPLIED

TRANSMISSION MECHANISM. — C. A. GROTZ, 4032 N. Francisco Ave., Chicago, Ill. An object of the invention is to provide a transmission mechanism by means of which any speed from zero to a maximum may be obtained by the manipulation of a single member such as a foot pedal or a lever. A further object is to provide transmission mechanism which may be used on all types of motor-driven vehicles, and which eliminates the bringing of gears into mesh and the consequent noise and wear occasioned thereby.

That Parallel Postulate

(*Continued from page 565*)

zation which the Euclidean has demanded that we produce, and the one which in the hands of the modern geometer has shown results.

In this two-dimensional geometry of surfaces in general, that of the plane is merely one special case. Certain of the features met in that case are general. If we agree that we know what we mean by distance, we find that on every surface there is a shortest distance between two points, together with a series of lines or curves along which such distances are taken. These lines or curves we call geodesics. On the plane the geodesic is the straight line. On surfaces in general the geodesic, whatever its particular and peculiar shape, plays the same rôle that is played by the straight line in the plane; it is the secondary element of the geometry, the surface itself and all other surfaces of its type are the tertiary elements. And it is a fact that we can take all the possible spheres, or all the possible French-horn surfaces, and conceive of space *as we know it* being broken down by analysis into these surfaces instead of into planes. The only reason we habitually decompose space into planes is because it comes natural to us to think that way. But there isn't a true, honest-to-goodness geometrical plane in existence any more than there is an honest-to-goodness spherical surface: so on intrinsic grounds one decomposition is as reasonable as another.

Certain of the most fundamental postulates are obeyed by *all* surfaces. As we attempt to discriminate between surfaces of different types, and get, for instance, a geometry that shall be valid for spheres and ellipsoid; but not for conicoids in general, we must do so by bringing in additional postulates that embody the necessary restrictions. A characteristic shared by planes, spheres, and various other surfaces is that the geodesics can be freely slid along upon themselves and will coincide with themselves in all positions when thus slid; with a similar arrangement for the surface itself. But the plane stands almost unique among surfaces in that it does not force us to distinguish between its two sides; we can turn it over and still it will coincide with itself; and this property belongs also to the straight line. It does not belong to the sphere, or to the great circles which are the geodesics of spherical geometry; when we turn one of these over, through the three-dimensional space that surrounds it, we find that the curvature lies in the wrong way to make superposition possible. If we postulate that superposition be possible under such treatment, we throw out the sphere and spherical geometry; if we postulate that superposition be only by sliding the surface upon itself we admit that geometry—as Saccheri failed to see, as Lobatchewsky realized, and as Riemann showed at great length in rehabilitating the "obtuse-angled hypothesis." Lobatchewsky's acute-angled geometry is realized on a surface of the proper sort, which admits of unrestricted superposition; but it is not the sort of a surface that I care to discuss in an article of this scope.

Where Euclidean Geometry Stands

Euclidean geometry is the natural and easy one, I suppose, because it makes it easy to stop with three dimensions. If we take a secondary element, a geodesic, which is "curved" in the Euclidean sense, we get a tertiary element, a surface, which is likewise curved. Then unless we are to make an altogether abrupt and unreasonable break, we shall find that just as the curved geodesic generated a curved surface, the curved surface must give rise to a "curved space"; and just as the curved geodesic needed a second dimension to curve into, and the curved surface a third, so the curved three-space requires a fourth. Once started on this sort of

thing, there doesn't really seem to be any end.

Nevertheless, we must face the possibility that the space we live in, or any other manifold of any sort whatever with which we deal on geometric principles, may turn out to be non-Euclidean. How shall we finally determine this? By measures—the Euclidean measures the angles of an actual triangle and finds the sum to be exactly 180 degrees; or he draws parallel lines of indefinite extent and finds them to be everywhere equally distant; and from these data he concludes that our space is really Euclidean. But he is not necessarily right.

We ask him to level off a plot of ground by means of a plumb line. Since the line always points to the earth's center, the "level" plot is actually a very small piece of a spherical surface. Any test conducted on this plot will exhibit the numerical characteristics of the Euclidean geometry; yet we know the geometry of this surface is Riemannian. The angle-sum is really greater than 180 degrees; lines that are everywhere equidistant are not both geodesics.

The trouble, of course, is that on this plot we deal with so minute a fraction of the whole sphere that we cannot make measurements sufficiently refined to detect the departure from Euclidean standards. So it is altogether sensible for us to ask: "Is the universe of space about us really Euclidean in whatever of realized geometry it presents to us? Or is it really non-Euclidean, but so vast in size that we have never yet been able to extend our measures to a sufficiently large portion of it to make the difference from the Euclidean standard discernible to us?"

This discussion is necessarily fragmentary, leaving out much that the writer would prefer to include. But it is hoped that it will nevertheless make it clear that when the contestants in the Einstein competition speak of a non-Euclidean universe as apparently having been revealed by Einstein, they mean simply that to Einstein has occurred a happy expedient for testing Euclideanism on a smaller scale than has heretofore been supposed possible. He has devised a new and ingenious sort of measure which, if his results be valid, enables us to operate in a smaller region while yet anticipating that any non-Euclidean characteristics of the manifold with which we deal will rise above the threshold of measurement. This does not mean that Euclidean lines and planes, as we picture them in our mind, are no longer non-Euclidean, but merely that these concepts do not quite so closely correspond with the external reality as we had supposed.

Illiterate Adults

(*Continued from page 566*)

were ignorant of the American language. During the war we have had an additional immigration of a million more adults who cannot speak our language. At present the rate of immigration is larger than during the tidal wave years of 1913 and 1914. The Literacy Test does not exclude illiterates, it merely eliminates some few, for the law makes many exceptions and no ability to read in our language is required. All that is required is knowledge of the simplest words in any foreign language.

The majority of immigrants now find so many of their compatriots here that the incentive to learn American grows less each year. As a rule employment is obtained readily at good wages by the alien without any knowledge of our language, with the consequence that we are rapidly becoming a polyglot nation, and mutual understanding through the existence of a common language is more and more difficult. This leads to increased overhead charges of all sorts in industry, makes a truly representative form of government difficult to attain, prevents industrial cooperation, lowers standards of living, im-

pairs the health and wellbeing of every community, and even threatens our very form of government.

Heretofore we have prided ourselves upon our literacy. We have taken it for granted that every American could read and write. But the result of the draft showed us that nearly a third of the picked manhood of the nation were unschooled to the point where they could not be accepted as soldiers because they could not understand military instructions of the most elementary sort. Scores of thousands could not distinguish between right hand and left hand. Those who could not read a word included native-born whites and negroes as well as foreign-born.

Slight provision is made in our schools for the needs of the adult. In our public schools, moreover, due to scanty pay, there is a present lack of sixty thousand teachers. This is the condition facing the administrators of education for children under sixteen or eighteen. The additional problem of teaching the adult foreign-born illiterate, the unschooled mountain white, and the negro is so vast that though every one of our seven hundred and fifty thousand public school teachers were to relinquish their work with children and should devote themselves to the instruction of adults who cannot read and write, even then we should not have a force of teachers sufficient to cope with the situation.

Illiteracy therefore is manifestly not the sole business of the schools and the school authorities. It concerns every American. It affects especially the employer, whether in industry or in the household. Half of the illiterates are women, many of whom are employed in factories or in homes.

Evening schools reach only a few of the most ambitious, for the majority of those who cannot read or write or speak our language cannot go to school. Evening schools in New York City have succeeded in the course of a year in reaching scarcely one-half of one per cent of the hundreds of thousands of illiterate aliens. The reasons are many: Industrial fatigue, family obligations, lack of means, and especially faulty school methods and failure to arouse and maintain interest.

A practical and effective method of teaching the illiterate to read is the institution of public school classes in the places of employment. The first workers' class was instituted in 1913 in New York City. There are now more than a thousand such classes in industrial establishments everywhere. In Chicago alone there are several hundred such classes in successful operation. It is not practicable to carry on these classes with complete success unless provision is made for attendance without loss of pay during daylight hours. An hour a day five days a week should be given during the period of instruction.

The latest developments in methods of instruction are Self Help Lessons in American to be put into the hands of the learner himself, and so arranged in method and manner as to be interesting and capable of being used without the aid necessarily of a trained instructor. Such elementary graded progressive lessons provide a language machinery which an adult can use successfully with slight help perhaps from a child who goes to American public school or from some friend who has had a little schooling. Such lessons can eventually be put in the hands of everyone.

It is practicable to develop a One Language Nation as well as a literate nation, but this needs the informed and hearty teamwork of directors of industry, leaders of labor, school authorities, legislators, the press, and the general public.

Democracy is measured by ability of each to share in the thought of all. Today thought is shared by means of the printed word. Therefore inability to read and absence of the reading habit is a barrier to true representation, be it social, industrial, or political. Yet we persistently avoid this obvious fact in our consideration of industrial relations and methods of civil government. The problem of the elimination of illiteracy from the United States is the problem of the most vital importance to us all, for it is basic to national prosperity and is the only means of unifying the nation.

Motor Trucks in Orchards

(*Continued from page 567*)

be used for different classes of work. In hauling fruit trays, or baskets, for instance, it is found desirable to have a wide platform on the chassis, while for other uses a closed or box body is required. In the raisin district of Fresno County motor trucks are used in large numbers to haul the grapes for drying and again from the drying fields to the packing houses and store rooms. The same is true of the prune districts of the Santa Clara Valley, while in the cherry center, in Alameda County, the trucks are largely used to haul the fresh fruit to market or to the cannery. Lake County is famous for its pears, and here, too, the motor truck is playing an important part in solving the transportation problems of the growers. In the orange and lemon districts of southern California, and the olive district of Butte County, motor trucks are depended upon to move the fruit from the orchards to the packing sheds.

As an example of the adaptability of the motor truck to different kinds of hauling jobs, we have the experience of Mr. Charles W. Mann, a fruit grower of Methuen, Mass. Mr. Mann has four different bodies for his 1½-ton truck, and since its purchase in 1911 this truck has run over 100,000 miles. He uses it to collect thousands of barrels of apples from orchards within a radius of 10 to 15 miles and then to deliver them to nearby markets, to freight cars, or to Boston, 11 miles distant. In one season this truck made two round trips to Boston daily for four weeks, averaging 120 miles a day.

With a double-deck body, Mr. Mann's truck will carry 50 bushels of strawberries or tomatoes without bruising them, and in one season he sold from it 50,000 baskets of berries and 4,000 bushels of tomatoes. The truck also hauled over 150 tons of hay in one season.

That motor trucks will reduce transportation costs has been shown in the experience of many owners. Mr. H. B. Wayland operates an orchard near Heards, Va., and the roads in his vicinity are not particularly good and some of them have high grades. In the old days Mr. Wayland used several four-mule teams for hauling to and from his orchard, and he estimated the daily cost of each of these teams at $5.22 even when idle. He hesitated about purchasing a truck on account of the condition of the roads, sometimes very muddy, but he finally purchased a 3-ton motor truck and in five months this truck covered 2,160 miles before winter closed the roads. The cost figures, in spite of the fact that this five months' work was of the roughest type, including regular road freighting and logging over narrow mountain trails on short, hard hauls, showed a net saving of 10 cents per ton-mile over mule and wagon haulage, and after this experience the mule teams were sold and the entire hauling work of the orchard done with the truck.

In the cranberry marshes of New Jersey the motor truck is doing good service, and in spite of the slippery bogs and the wide stretches of sands, the truck is supplanting animal teams. One such truck made from 20 to 25 complete 4½-mile trips daily during the picking season. The truck has replaced five teams and surpassed the record of the teams by approximately 100 per cent.

In many cases the use of motor trucks has enabled fruit growers to save their

Cover Crops for Our Orchards

(*Continued from page 567*)

husbandman for the renewal of the corn crop next year.

Not so with the fruit tree. It must serve long years; bear patiently all the vicissitudes of vegetable life; produce fruit abundantly, even in the extremity of old age.

Nor is the fruit tree indifferent to man's care and attention. It smiles its gratitude in terms of vigorous wood growth, luxuriant leafage, a profusion of beautiful spring bloom, and finally a crop of fruit richly tinted and colored to please the eye, and gushing with pleasant juices, wherewith to gratify the appetite of man.

Cover crops may be used handily and effectively in the art of mulching. Mown cover growths gathered about a tree, carefully placed in regular form, and to a proper depth, may be made to serve various purposes—stifle weeds or foul growths that may have sprung up around the tree, conserve moisture by preventing too rapid evaporation; and the refertilization of the soil immediately around the tree, where it is most needed.

Rainfall may thus be absorbed and held in suspension for the better nourishment of the tree; moisture from lower sources may be also brought up and made to do good service. And, as in a hundred other instances the farm tractor comes upon the scene as a most efficient tool to be used in the cultivation of cover crops.

It is both handy to use, and effective in its action. One of the most awkward phases of orchard culture that has come under my own observation was the cultivation of orchards by means of horsepower. Time and again I have watched some unlucky wight tooling a plow, a walking plow at that, and a pair of farm horses beneath the umbrageous roofage of a California orchard. The plowman, grasping tenaciously the two plow handles, plodding mile after mile in a muddy, sticky furrow; now watching the plow and then throwing a quick glance to his team, the occasional jerk on the lines which are hooked over his own neck because his two hands are otherwise engaged, and then emitting a blue streak of profanity for the better guidance of his team and the delectation of chance passersby, was the scene in outline.

A dull and sordid task calculated to exhaust the body and jar the moral fiber with bitter memories. Then the vain attempts to induce those poor horses, as the slow furrowing proceeded, reverently to bow their heads and crawl beneath the tree tops in order that the plowing might be carried nearer the vital parts of the trees!

But why recall those scenes of rustic toil and tribulation of the spirit, when they have passed, or are about to pass into the realms of oblivion and utter extinction?

And now we behold this emancipated son of toil seated cheerfully upon the throne of the farm tractor, gently steering the apparatus between innumerable rows of fruit trees, turning up the mellow mold through which he once plodded with leaden feet and heavy heart. Gently he guides the machine up beneath the low-bending branches until he seems to be in imminent danger of barking the tree.

But no: Never a bark! Neither is the tractor asked to bow its head; because it is headless and has an orchard top to it.

Now as to various plants that are adapted to cover crops under California orchard conditions: There is *Melilatus*, or Bitter clover. This is an early starter, makes a good growth during the winter, sometimes attaining the goodly

height of three feet before it is ready to plow under. It is not good either for hay nor forage but makes an ideal special green manure, or cover crop. Sow from ten to fifteen pounds of seed to the acre, and plant very shallow, say a quarter or a half inch deep.

Burr Clover, or *Medicago denticulata*, is a native of California; makes not only a good cover crop but a fine dry forage for summer use. In practical use the Latin name may be abandoned without endangering the crop.

Spring Vetch, or *Vicia sativa*, is a hardy plant and is extensively used as a cover crop. The seeds are of a large size, and it requires from sixty to seventy pounds to the acre for a proper seeding.

Hairy Vetch, or *Vicia villosa* is a hardy winter plant; stands cold weather well and makes a luxuriant growth. Sow from 30 to 40 pounds of seed to the acre.

Canada field peas make both an ideal cover crop and a good forage plant for cattle. You may plant it late in the season, yet get a good crop. Sow from 70 to 80 pounds to the acre.

Sweet Clover, or Bokhara, or *Melilotus alba* makes a good cover crop. It is a biennial and is noted for its deep-rooting faculty. Sow ten pounds of seed to the acre.

Asbestos in Architecture

(*Continued from page 572*)

water does not give the desired results, because the asbestos aggregate and the cement particles are drawn together in more or less separate groups or masses. Without going into details, these formations react in such a way to the water that they exclude all but a small percentage of that fluid; and as a consequence the imperfectly wetted mixture represents very largely nothing more than unhydrated cement bound together by a network of more thoroughly hydrated cement "gels." This fact explains why some asbestos shingles, corrugated roofing, and siding have failed to meet expectation.

In the Hatschek process, as standardized here by the best of our manufacturers, the order of procedure is as follows: First, 85 per cent of hydraulic cement of a superior grade and 15 per cent of asbestos fiber of the chrysotile variety are carefully mixed with water by means of a beating machine much like that employed in the production of paper pulp. Prolonged mixing and agitation make a uniform fluid composition having the properties of a colloidal diffusion. The small, solid particles will remain in suspension for a long while. The soft, pastelike mass lends itself readily to working on a millboard machine without setting or hardening the while. It seems that there is no separation of the cement even when the pulp is finally subjected to high pressure. At that time only clear water passes off the rolls.

After leaving the beating machine the colloidal substance goes to a vat where it is kept agitated until picked up by a fine wire screen mounted on a rotating cylinder. From this it is transferred to an endless belt of felt which brings the material between two horizontal steel rolls 96 inches in circumference and 42 inches long, where pressure is applied to expel much of the water. Despite the fact that the surface of the upper cylinder is highly polished, still it attracts the composition away from the felt belt and builds up upon itself successive layers of the substance until the desired thickness is attained. Next, the accumulation is freed from the cylinder by a single longitudinal cut which forms it into a sheet.

Owing to the numerous layers composing a sheet, the manner in which the asbestos fibers are interlocked as the succeeding layers are brought together under pressure and the completeness of the original mixing of the cement and asbestos, a final texture results possessing marked homogeneity and pronounced toughness. But don't let us anticipate.

After the sheets leave the rolls they are cut up into shingles and "starter pieces" in a way that results in comparatively little waste. These shaped units are then put between steel plates, and when a number of "sandwiches" are ready they are subjected to a pressure of 10,000 pounds to the square inch. This pressure removes the bulk of the moisture and gives the shingles and starter pieces a smooth surface. They are then seasoned, trimmed, drilled, bundled and stored for shipment. The residual moisture does not escape until it has indissolubly bound the cement and asbestos. As the moisture evaporates the shingle becomes more compact and tougher. In short, it grows stronger as time goes on.

In making corrugated roofing and siding the sheets from the rolls are placed immediately between corrugated metal plates and are subjected to a pressure of 20 tons or more to the square foot. This compacting pressure eliminates the minute voids that might otherwise remain in the material. The ultimate product is water resisting. After compression, the material is stored in a damp room to prevent drying out of the surface until the stuff is thoroughly set. Then follows a seasoning period. In manufacturing asbestos building lumber, which is turned out in the form of flat sheets of varying thicknesses, they are naturally placed in the hydraulic presses between flat plates. The lumber, when ready for marketing, can be easily sawed, cut, drilled, punched, and nailed in position. It is employed for walls, ceilings, paneling, and wainscoting. It is also used for doors, screens, pipe and wire conduits, table tops, fire walls, and the lining of elevator shafts, stairways, corridors, etc. Apart from the fact that the material is well-nigh indestructible and non-combustible, it has money-saving virtues, for it can be put in place much quicker than stucco or plaster, does not crack when exposed to the weather, and avoids the expense and labor of occasional painting.

With coal costing more from year to year, the heating of the home and other sheltering structures has become a matter of concern, and it is important to check radiation from the pipes and flues of steam, hot water, and hot-air conduits. This, asbestos coatings are doing but not to the extent that proper economy warrants. Similarly, cold water pipes which might sweat hurtfully in the presence of warmer air can have this tendency arrested by covering them with asbestos; and a protecting shield of this sort upon the water-supply pipes is one of the surest safeguards against freezing and a vexatious bill from the plumber. Again, asbestos jackets, lagging and the like can hold heat at bay in all kinds of refrigerating equipments—reducing outlays for either ice or initial energy, according to the system. Finally, asbestos building felt is an admirable substitute for the inflammable felts or papers now so commonly used as a floor lining and a general sealing medium in frame houses. Owing to its character as a non-conductor, this insulating felt serves also to arrest the penetration of heat in the summer months, thus making for a cooler habitation.

While the United States is the greatest user of asbestos products, our own mines yield less than 1 per cent of the raw material worked up here. It is said that Canada furnishes the world with 90 per cent of the marketable asbestos, and we use 60 per cent of the output of the famous Quebec mines.

NEW BOOKS, ETC.

ELECTRO-DEPOSITION OF METALS. By Dr. George Langbein. Translated by William T. Brannt. New York: Henry Carey Baird and Company, 1920. 8vo.; 983 pp.; 185 engravings.

The entrance of this standard work upon its eighth edition has provided opportunity for a complete revision and a substantial enlargement. It contains encyclopedic information on electroplating, galvanizing, and electrotyping, the contact and immersion processes, coloring of metals, lacquering, and grinding and polishing. Shop equipment receives much attention, and not the least valuable feature of the work is the practical formulas and trade secrets that cover the solutions employed. Descriptions of machinery and apparatus are freely augmented by good illustrations, and the whole presentment is so plainly worded as to be immediately understandable to the plater and metal finisher.

ARTIFICIAL LIGHT. Its Influence Upon Civilization. By M. Luckiesh. New York: The Century Company, 1920. 8vo.; 366 pp.; illustrated.

It is hard for us to realize into what Egyptian darkness sundown plunged our world not so many years ago. The torch, the candle, the oil lamp, gas, electricity—this historical progress is entertainingly chronicled by the author. He tells of street lighting, home illumination, and artificial light in warfare and in spectacular effects. As usual, he has a word to say on lighting as a fine art; and he discusses light in its relations to health and safety, with some consideration of costs, and a chapter on the light of the future. This story of man's conquest of darkness is stamped with the ease of accurate knowledge and the ability to interest the general reader.

THE LIFE AND WORK OF SIR HIRAM MAXIM. By P. Fleury Mottelay. New York: John Lane Company, 1920. 8vo.; 230 pp.; illustrated.

The author was secretary to Sir Hiram, who furnished, by personal dictation and by manuscript accounts, much of the information that makes up the volume. Each section deals with a particular phase of inventive activity—the automatic gun, explosives, aerial navigation, gas machines, oil experiments, etc. Lord Moulton's introduction draws a picture of the man and inventor as he knew him, and an excellent frontispiece portrait shows Sir Hiram at the age of seventy-four. Appendices contain valuable notes and cite the list of patents granted the subject of the biography by the American and British Governments.

AMERICA'S MARITIME PROGRESS. By George Weiss and J. W. Leonard. New York: The New York Marine News Company, 1920. 4to.; 525 pp.; illustrated.

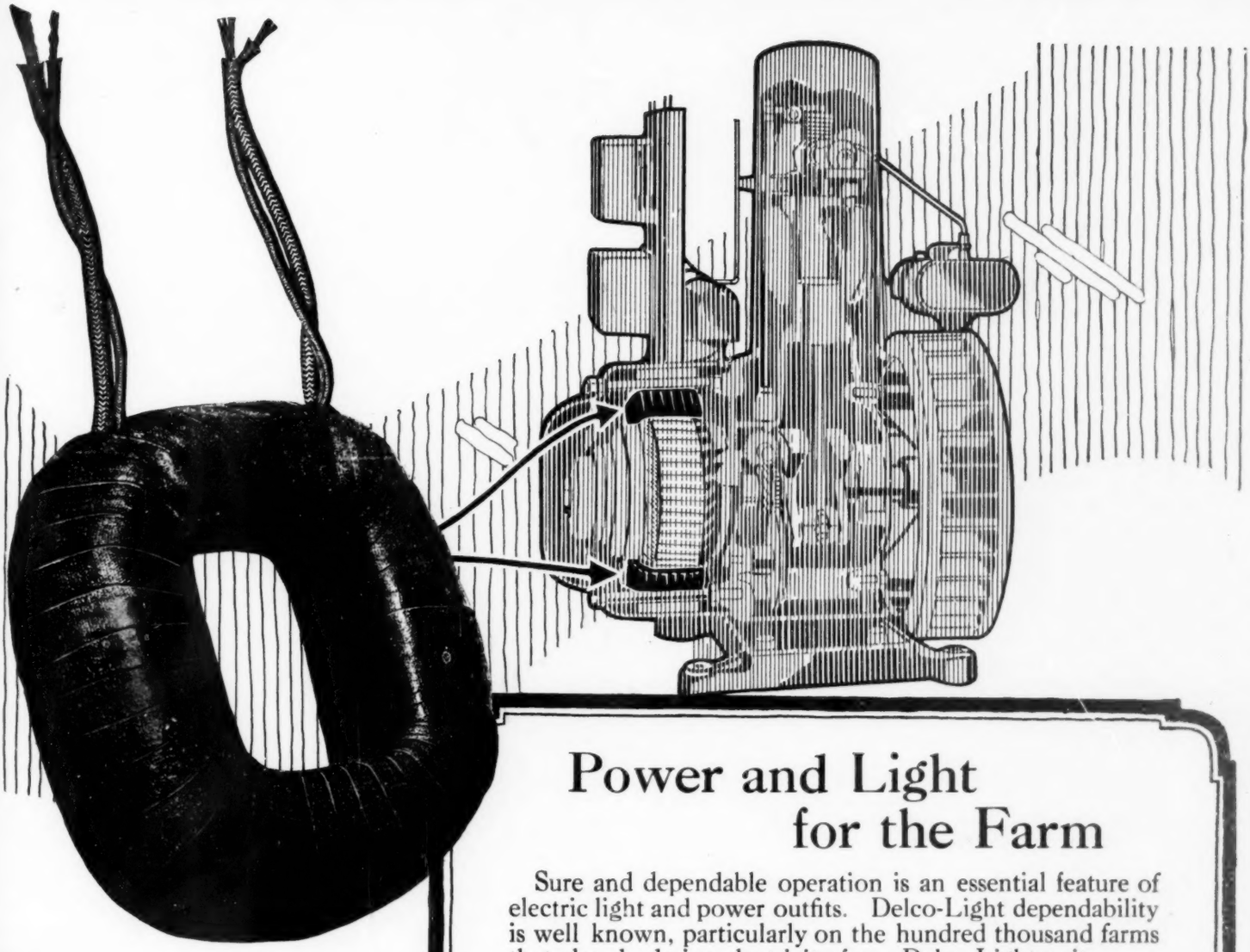
Large pages, tinted paper, good print-work and fine plates make very attractive this history of our wonderful rehabilitation. It recounts how American shipping pulled out of the plight in which it stood before the war, and shows how coöperation and standardization led to the breaking of building records and a forward leap in foreign commerce. Four-fifths of the work is devoted to descriptive sketches of representative companies of the shipping world, with biographies and photographs of the big men of the industry. Among the full-page plates are shipyard scenes, launchings and various types of our great cargo carriers.

AERONAUTICS. Fourth Annual Report of the National Advisory Committee for Aeronautics, 1918. Washington: Government Printing Office, 1920. 4to.; 654 pp.; illustrated.

The report gives a clear account of facts collected and verified and work done. The methods and machinery of important experiments are closely described, and there is a lay-out of general problems and activities with the trend of progress indicated. The technical papers, occupying the major portion of the large volume, include Nos. 24-50, and deal with nomenclature, navigational theory and phenomena, air propellers, general construction, tests of balloon fabrics, gas, and engine fuels, and other experiments and deductions. All interested in aircraft should follow recent development as here authoritatively outlined, and learn what our coöperating experts accomplished.

OCEAN SHIPPING. Elements of Practical Steamship Operation. By Robert Edwards Annin. New York: The Century Company, 1920. 8vo.; 427 pp.; illustrated.

"The Century Foreign Trade Series" makes its appearance with "Ocean Shipping," by a member of a great shipping firm. The sudden expansion of our fleet finds us hard pressed for men familiar with the machinery of foreign trade and the management and operation of its freighters. Here the ambitious man is given the gist of thirty years' experience—actual practice as it touches office organization, traffic management, wharf work, stowage; insurance, forms and accounts, and charters. Most phases and problems are fully covered, and the timely and able work not only informs, but stimulates.



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2 You get the economy of the "Handy Grip" Stick, which enables you to use every bit of your soap—and saves the purchase of a new metal box with each stick of soap. The Refills screw in as did the original stick.

3 You will probably get the habit of using the stick, which is the most economical form of shaving soap. We can tell you this *impartially* because we make Shaving Powder and Cream as well as Sticks.

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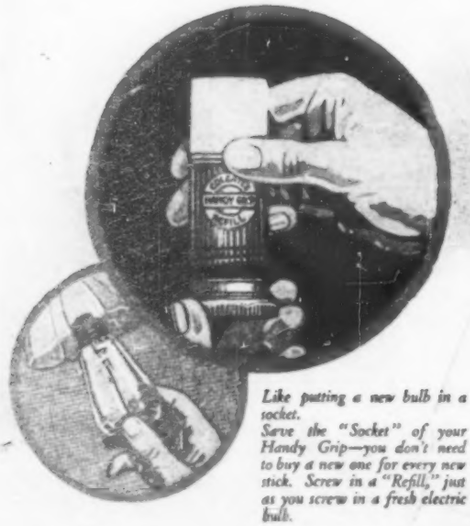

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